

Review of the Borboroidini or Wombat Flies (Diptera: Heteromyzidae), with Reconsideration of the Status of Families Heleomyzidae and Sphaeroceridae, and Descriptions of Femoral Gland-baskets

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ABSTRACT. Reasons are given for reducing the Heleomyzidae and Sphaeroceridae to a single family, to be known as Heteromyzidae on grounds of priority. Some aspects of morphology and associated terminology are discussed. Difficulties in using male genitalia characters for higher classification are pointed out. The diverse gland-baskets, present on the hind femur of most *Borboroides* spp. are described and illustrated. The peculiar stridulatory organ on the fore leg of both sexes of *Borboroides musica* is described. The apparent groundplan characters of the Heteromyzidae are listed. The relationships of the Chyromyidae and Mormotomyiidae to the Heteromyzidae are briefly discussed and each is excluded from the Heteromyzidae. A provisional grouping of the Australasian heteromyzid tribes into subfamilies is put forward. A revised key to the Australian non-sphaerocerine genera of Heteromyzidae is given. Within this broadly defined family, the endemic Australian tribe Borboroidini includes the genera *Borboroides* (23 species) and *Heleomicra* (two species). The species of *Borboroides* are classified into six informal groups to reflect morphological diversity and probable phylogenetic relationships. The following new species are described: *Borboroides stewarti*, *B. musica*, *B. danielsi*, *B. lindsayae*, *B. tonnoiri*, *B. donaldi*, *B. perkinsi*, *B. dayi*, *B. staniochi*, *B. helenae*, *B. doreenae*, *B. parva*, *B. menura*, *B. gorodkovi*, *B. shippi*, *B. corynetes*, *B. petiolus*, *B. fimbria*, *B. bulberti*, *B. merzi*, *B. acumen*, *B. woodhilli*, *Heleomicra lenis*. Adults of some species of *Borboroides* and *Heleomicra* are attracted to old carrion or marsupial dung or both, and wombat dung is probably a suitable larval medium for some species.

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Malloch (1925) first described the genus *Borboroides* in the family Borboridae (= Sphaeroceridae). Richards (1973) transferred the genus to the Heleomyzidae. D. McAlpine (1985) established the endemic Australian heleomyzid tribe Borboroidini to include *Borboroides* and *Heleomicra*. D. McAlpine, and indicated that both genera contained undescribed species.

Recent field work has resulted in collection of good series of numerous species, particularly of *Borboroides*,

and it appears likely that most existing species, at least in southeastern Australia, are now available for description. Numerous species have only been found or were most frequently found in habitats of larger marsupials, particularly wombats, and have been collected at fresh (or fresh-frozen) wombat dung, or occasionally at wallaby or kangaroo dung. Some of these species have also been found at carrion, and *Borboroides menura* n.sp. and probably *B. petiolus* n.sp. have so far only been collected at carrion. Further ecological

details and circumstances of capture are noted under the species.

These records illustrate the dependence of significant elements of the Australian insect fauna on the native vertebrates and particularly indicate why it is important to conserve natural populations of wombats. It is intriguing to consider the possibility that Australia may have had a much greater diversity of borboroidine species when *Diprotodon optatum* Owen, *Procoptodon goliah* (Owen), and other now extinct very large marsupials abounded c. 100 000 years ago (Long *et al.*, 2002).

I believe that I obtained larvae of *Borboroides musica* n.sp. through rearing in wombat dung, but, as the culture was contaminated with other Diptera, I defer giving a larval description.

The following collectors' names are abbreviated to the initials: D.R. Britton, G.L. Bush, J.C. Cardale, R.O. Chalmers, D.H. Colless, I.F. Common, G. Daniels, B.J. Day, A.L. Dyce, M. Fitzgerald, L.F. Graham, G.H. Hardy, G.A. Holloway, K.C. Khoo, J. Kukalová-Peck, Z.R. Liepa, R. Lindsay, B.J. Marlow, D.K. McAlpine, B. Merz, M.D. Murray, I.D. Naumann, S.J. Paramonov, S.B. Peck, F.A. Perkins, E.F. Riek, F.H. Taylor, A.L. Tonnoir, M.S. Upton.

Institutions housing specimens are abbreviated as follows:

AM	Australian Museum, Sydney
ANIC	Australian National Insect Collection, CSIRO, Canberra
BM	The Natural History Museum, London
CNC	Canadian National Collection, Agriculture Canada, Ottawa
MHNG	Museum of Natural History, Geneva
MV	Museum of Victoria, Melbourne
NAT	Natal Museum, Pietermaritzburg
OX	University Museum, Oxford
TAU	Department of Zoology, Tel Aviv University, Tel Aviv
TDPI	Department of Primary Industries, New Town, Tasmania
UQ	Department of Zoology and Entomology, University of Queensland, Brisbane
USNM	National Museum of Natural History, Washington, D.C.
WAM	Western Australian Museum, Perth

Where specimens, particularly type series, are the property of the Australian Museum, it has sometimes been possible to place a small number of these in other key institutional collections on an exchange basis.

Under the heading *Dimensions*, total length excludes antennae and abdominal parts behind tergite 5. Length of wing is the *total* length of the wing. Paired structures are described in the singular, except where the context makes this inappropriate.

Status of families

Heleomyzidae and Sphaeroceridae

The family Heleomyzidae s.l. (sensu D. McAlpine, 1985) has not proved amenable to division into narrower monophyletic groupings of sufficient significance for recognition at family or even subfamily level. For this reason McAlpine (1985) classified the world heleomyzid genera into 22 tribes. There has, however, been a tendency for European workers over many years to divide the family up when treating the Palaearctic taxa (most recently by Papp, 1998b), but such systems have been found not easily applicable to the world fauna (Gill, 1968; J. McAlpine, 1989), and phylogenetic relationships within the broad family are still very incompletely understood. I have defined the tribes Heleomyzini and Suilliini as probable monophyletic groups (D. McAlpine, 1985), and Papp (1998b) regarded these groups alone as comprising the family Heleomyzidae. However, I have not found any distinctive synapomorphies to justify this association, and this family concept is characterized mainly or exclusively by plesiomorphies.

I believe that the monophyletic group known as the family Sphaeroceridae is phylogenetically nested among the more derived tribes of Heleomyzidae s.l., perhaps including Cnemospathidini, Rhinotorini, and Trixoscelidini (as delimited below), but elucidation of relationships among these groups may depend on molecular studies. This view has been strengthened during my recent study of the morphology of *Borboroides*. The characters of the sphaerocerid groundplan conform remarkably closely to the list of groundplan character states for the Heteromyzidae (Table 1). Two character states previously given for the Heleomyzidae (D. McAlpine, 1985: 217)—“interfrontal bristles, when present, not in longitudinal series set on pair of differentiated plates,” and “hind basitarsus not exceptionally short and compact”—were given arbitrarily to exclude the Sphaeroceridae. Also, the first character does not provide an invariable clear-cut distinction, and even the experienced dipterist J.R. Malloch had difficulty when he described *Borboroides* in the “Borboridae”.

My view partly agrees with that of Roháček (1998) in so far as the Sphaeroceridae are seen to be derived from within the paraphyletic Heleomyzidae (sensu D. McAlpine, 1985). But Roháček sees the solution to this situation as the division of Heleomyzidae into a number of families “when the postabdominal structures are better known.”

I have previously (1985) concluded that male postabdominal characters are unlikely to solve the problem of higher level classification among the heleomyzid-like flies, though limited input is to be expected. The basic reason for this is the exceptional evolutionary instability in these structures, which accompanies the speciation process, and the consequent difficulty in phylogenetic evaluation of the characters at family level. Many groups of Diptera (and other animals; see D. McAlpine, 1988) evolve the first noticeable difference between pairs of closely related species in male postabdominal organs, and the comparative study of specific characters shows that this process of morphological divergence can be repeated in almost every speciation cycle. An example of the resulting structural diversity in the aedeagus of one narrow species group of the heleomyzid tribe Allophylopsini (*Diplogeomyza*, group 4) is shown by D. McAlpine, 1967: figs 21C, 22D, 23C, 24C, 25C. Further

Table 1. Probable groundplan conditions of Heteromyzidae.

- Face uniformly sclerotized, with shallow transverse groove close to ventral margin, which is thus slightly everted;
- postvertical bristles strongly convergent; fronto-orbital bristles two, more or less reclinate;
- anterior part of postfrons setulose, interfrontal bristles not strongly differentiated from these setulae;
- vibrissa well developed;
- antennal segment 2 not dorsally slit, nor forming a hood- or cup-like structure over base of segment 3, with prominent, asymmetrical conus (Fig. 166);
- antennal segment 3 without dorsobasal process fitting into segment 2;
- dorsocentral bristles three or more;
- presutural (posthumeral) bristle well developed;
- scutellar bristles two subequal marginal pairs;
- sternopleural bristles one or two;
- prosternum moderately narrow, without precoxal bridge;
- mid femur with few non-seriate anterior bristles near mid-length;
- each tibia with one well-developed preapical dorsal bristle;
- fore and hind tarsus each with male-restricted apical ventral process (or with genetic potential to produce such process under certain changes of the genome; see Fig. 167);
- mid basitarsus longer than either fore or hind basitarsus;
- costa with break or short zone of desclerotization at subcostal position;
- second basal cell closed;
- anal cell closed;
- distal section of vein 6 extending almost to wing margin, at least partly sclerotized beyond anal cell, and approximately aligned with section bordering anal cell;
- vein 7 represented beyond alular incision by a distinct curved crease in membrane;
- subcosta distally diverging from vein 1, strongly developed to termination in costa, without weakening or break beyond humeral crossvein;
- male tergite 6 small;
- male postabdominal sternites strongly asymmetrical; sternites 6 and 7 located on left side;
- female postabdominal segments only moderately extensile; segments 6–8 with separately sclerotized tergite and sternite;
- female cerci separately sclerotized from each other and from epiproct.

examples of aedeagal diversity in other taxa of this tribe are illustrated by me (op. cit.) and Tonnoir & Malloch (1927). Hennig (1969) recorded structurally different aedeagal types in the tribe Gephyromyzini. In the current study of *Borboroides* spp. the phenomenon of diverse structure in the hypandrial-aedeagal complex is repeated; contrast, for example, that of *B. helenae* (Fig. 84) with that of *B. merzi* (Fig. 144), and *B. doreenae* (Fig. 87). In *B. parva* (Fig. 95) the aedeagus is of fundamentally different structure

from that of other *Borboroides* species and is, in external features, remarkably like that of the aberrant neurochaetid *Nothoasteia clausa* McAlpine (author's unpublished studies). However, there is adequate morphological evidence (and in the latter case behavioural evidence) to show that each of these two species is correctly placed systematically, and that the resemblance is convergent. Marked differences in the protandrium also occur between apparently related heleomyzid-like taxa (examples in D. McAlpine, 1985). Edwards (in Malloch, 1933: 199) noted the great difference in the protandrial sclerites between the otherwise very similar genera *Prosopantrum* Enderlein and *Notomyza* Malloch. He concluded: "... it seems evident that great caution should be used in employing these organs for purposes of classification."

Griffiths (1972) proposed an innovative classification of the Cyclorrhapha largely on the basis of male postabdominal characters. This work provided many helpful insights, but his widely scattered placement through the taxonomic system of such heleomyzid-like genera as *Heteromyza* Fallén ("Heteromyzidae"), *Prosopantrum* Enderlein ("Cnemospathidae"), *Notomyza* Malloch ("Notomyzidae"), and *Neossos* Malloch ("Chiropteromyzidae") demonstrates how easily one can be misled when too much reliance is placed on these characters.

A difficulty in heleomyzid classification may have arisen from lack of preservation of useful apomorphies that can be used in cladistic arguments. Where phylogenetic radiation has involved numerous short internodes (short in time and/or in terms of morphological change), there is no reason to expect that sufficient distinctive and stable character states informing us of sequence of clade formation will have survived to the present. Such short-internode radiation may have taken place in heleomyzid flies in the early Tertiary, and could cause difficulties, perhaps more with purely morphological interpretations than with thorough DNA-based work. Even though the sphaerocerines are recognized by a set of distinctive apomorphies, it is by now apparent that convenient recognition marks of this order are unlikely to be found for most other major heteromyzid clades.

It is clear that the Heleomyzidae s.l. and the Sphaeroceridae cannot be maintained as two separate families in a system which attempts to reflect phylogenetic principles. Thus either (A) they should be combined as a single family; or (B) the paraphyletic group known as Heleomyzidae s.l. should be divided into a number of evidently monophyletic smaller families, which, together with the Sphaeroceridae would comprise a superfamily of the Schizophora. In support of alternative (B), it has been suggested to me that, because the traditional group Sphaeroceridae is very speciose and has been the focus of studies by specialists, it should be recognized at family level, even though several small and less known groups may need to acquire family status as a result of this recognition. I do not see this as a consistent argument, and am opposed to a classification that suits sphaerocerid specialists, but distorts or causes long-term instability in the rest of the superfamily. Because (1) alternative (B) is not at present practical, (2) attempts to achieve this in the immediate future are likely to lead to highly subjective and unstable results, and (3) the family category is best treated, where possible, as a broad grouping that can be appreciated by the non-specialist, I now propose the family-level synonymy of Sphaeroceridae and Heleomyzidae.

Family nomenclature

The three most senior available family group names applying to taxa of the sphaerocerid-heleomyzid complex are as follows (from Sabrosky, 1999, q.v. for publication details):

- 1 Heteromyzides Fallén, 1820. Type genus *Heteromyza* Fallén, 1820.
- 2 Sphaeroceridae Macquart, 1835. Type genus *Sphaerocera* Latreille, 1804.
- 3 Helomyzides Westwood, 1840. Type genus *Heleomyza* Fallén, 1810 (misspelt *Helomyza*).

While acknowledging that continued use of the name Heleomyzidae for a family including *Heteromyza* “would require action by the ICZN under Suspension of Rules”, Sabrosky (1999) saw a case for conserving Heleomyzidae “in the interests of stability.” However, he did not fully take into account (1) the existing very diverse scope attributed to Heleomyzidae by various authors, or (2) the possibility of both name change and greatly increased scope if the family were to be merged with the Sphaeroceridae. The argument, that either of the familiar names Sphaeroceridae or Heleomyzidae should be used for the newly defined family, loses its force, because this familiarity is based on a substantially different delimitation for each family name, and its use in the new sense can cause some confusion.

The family name Heteromyzidae has had much less use in modern literature, and its use (in the special sense of Griffiths, 1972) has virtually ceased. However, the family group name based on the nominal genus *Heteromyza* cannot be eliminated from nomenclature as a nomen oblitum because it is in recent use for a subordinate group within the “Heleomyzidae” (Gorodkov, 1984; Papp, 1998b), and in this sense has no synonyms.

Heteromyzidae has priority over Sphaeroceridae and Heleomyzidae under the ICZN and I consider that its adoption for the sphaerocerid-heleomyzid complex, defined as a family for the first time, is most appropriate. The name Heteromyzoidea n.stat. becomes the correct name for the superfamily termed Sphaeroceroidea by J. McAlpine (1989) and Heleomyzoidea by Colless & D. McAlpine (1991).

Morphology and related terminology

Most morphological terms here used are explained by D. McAlpine (1973), Harrison (1959), Crosskey (1973), or Colless & D. McAlpine (1991). Morphological study for this paper has been performed with use of a stereo light microscope (SLM), compound light microscope (CLM), and scanning electron microscope (SEM).

In the specific descriptions, the section on coloration also includes surface texture. I use the term **glossy** to indicate a strongly reflective cuticular surface which bears neither fine ridging (fingerprint sculpture, Fig. 57) nor pruinescence (short, dust-like microtrichia). **Shining** is a more general term applied to surfaces showing marked more or less regular reflection, but with some fine parallel ridging and/or sparse pruinescence often conveying a satiny sheen, which tends to change with angle of view. These conditions of texture can usually be discerned with higher magnification of the SLM on clean dried specimens, but can be better illustrated using the SEM (e.g., Figs 57, 88, 121). They are difficult to interpret with SLM under liquid.

Trichoid hairs of the cuticular surface are broadly classified into **microtrichia**, rigidly attached to the cuticle without a basal socket, and **macrotrichia**, which arise from a basal socket containing a ring of soft, membranous cuticle rendering them flexible from their bases. Macrotrichia are often larger than microtrichia, but see Fig. 10 for an exception to this rule.

Microtrichia may take the form of **pruinescence**, zones of small microtrichia on the cuticle giving the appearance of a dull surface, or **pubescence**, groups of longer, somewhat pile-like or brush-like microtrichia. The trichoid hairs of the surface of the wing membrane (but not those of the marginal fringe) in cyclorrhaphous Diptera, as in most Mecoptera, are microtrichia (D. McAlpine & de Keyser, 1994), in contrast to those of Lepidoptera, which are generally scale-like macrotrichia. Further unusual modifications of microtrichia are described below in connection with the stridulatory organ of *Borboroides musica*.

Six main kinds of macrotrichia are readily recognized in the Heteromyzidae. **Setulae** are moderate-sized unspecialized macrotrichia usually irregularly distributed on certain parts of the cuticle. **Bristles** are relatively large macrotrichia individually or serially differentiated from setulae, e.g., vibrissa, dorsocentral bristles. The term seta is sometimes substituted for bristle but has had a confusingly diverse usage. **Tibial spurs** are a special type of bristle located terminally or subapically on some tibiae. In the Diptera, as in some other insect orders, they have a long phylogenetic history of differentiation from other kinds of macrotrichia. **Spinules** are macrotrichia of condensed form, being short and relatively thick. Some spinules on the surstylus of males of *Borboroides menura* and *B. woodhilli* are distally divided into several lobes arranged in one plane (Figs 100, 153). These are termed **digitate spinules**. **Mollisetae** are long macrotrichia which become attenuated, soft, and usually curled on their apical parts (Figs 52, 55). The more conspicuous kinds are usually male-restricted. **Ommatrichia** are small macrotrichia inserted between the facets of the eye surface. In the Heteromyzidae they are generally few and inconspicuous under ordinary magnification (SLM), though often present.

I use the term **postvertical bristles** for the bristle pair immediately behind the ocelli. These are most frequently convergent or crossed in the Heteromyzidae—always so in the Borboroidini. About halfway between the postvertical bristle and the outer vertical bristle, there may be a smaller bristle, the paraverticlar—always distinct in *Borboroides* spp and absent in *Heleomicra* spp. See D. McAlpine (2007) for terminology of these and adjacent bristles.

I use the term **prelabrum** for the transverse sclerite between the face and labrum in the cyclorrhaphous Diptera. The use of the term clypeus for this sclerite (e.g., by J. McAlpine, 1981) appears to be an error of homology. See D. McAlpine (2007) for discussion. In most species of Borboroidini, as in some other cyclorrhaphous taxa, the prelabrum is sexually dimorphic, being slightly to markedly smaller in males.

The antenna is treated as a six-segmented appendage, and the segments, including those of the arista, are numbered consecutively from the base. The arista thus generally consists of segments 4 to 6, but in a few sphaerocerine heteromyzids (e.g., *Thoracochaeta brachystoma* (Stenhammer); see D. McAlpine, 2002) the arista is two-segmented through loss

of segment 4. Segment 4 is present but short and annular in the Borboroidini (Figs 27, 93, 161).

The articulation between antennal segments 2 and 3 is usually complex in cyclorrhaphous Diptera. Often, as in the Heteromyzidae, the distal articular surface of segment 2 bears a substantial but largely concealed prominence, the conus (Disney, 1988). The foramen of articulation with segment 3 occupies a remarkably small area on the outer lateral to subterminal part of the conus. The conus of *Heleomicra* is broad and short (Fig. 161), but it varies in length among the species of *Borboroides* (e.g., Fig. 166).

I use the term **hypopleuron**, following numerous precedents, for the thoracic meropleuron plus metapleuron, because its component parts are not generally distinguishable in these flies.

General terminology for parts of the male postabdomen has been given by D. McAlpine (1985) with application to various heteromyzid taxa. The genus *Borboroides* shows some unusual features, and these need to be considered here.

The protandrium consists of segments 6 to 8 of the male abdomen. Tergite 6 is quite small and separate from other sclerites, or not distinctly sclerotized. Sternite 6 in *Borboroides* is primitively located on the left side of the postabdomen where it forms a dark sclerotized band generally attached dorsally to the anterior margin of sternite 8. In most species of the *atra* group sternite 6 encircles the abdomen and is approximately symmetrical, though sometimes with complex structure on its ventral part (Fig. 150). The principal protandrial sclerite is the inverted sternite 8 which always has a sclerotized ventral bridge of variable extent to produce a partly tubular sclerite. Segment 8 is usually quite long and often petiole-like, but, even in *Borboroides parva*, in which the protandrial complex is much shorter than in other species, the ventral bridge of sternite 8 is retained (Fig. 94). The posterior extremity of tergite 8 has a prominence on each side which serves as a condyle for articulation with the epandrium or genital capsule.

Following other workers on Cyclorrhapha, I have used the device called the protandrogram to illustrate the form and disposition of the tergites and sternites of segments 6 to 8 of the male abdomen of certain species (Figs 53, 135, 150; see D. McAlpine, 1985 for further explanation and protandrograms for numerous heteromyzid taxa). These diagrams show the sclerites of the protandrial segments as if slit along the medial ventral line and spread flat.

The *atra* group of *Borboroides* is remarkable among heteromyzids for the approach to almost complete symmetry of the protandrium in most species (e.g., Fig. 150). The claim by Griffiths (1972) that a species of *Notomyza* Malloch (tribe Notomyzini) has the postabdomen fully symmetrical needs checking. In my study of "heleomyzid" genera (D. McAlpine, 1985), I found no other examples of symmetrical protandria. Marshall & Richards (1987) and Roháček (1998), with their detailed knowledge of "Sphaeroceridae", categorize the postabdomen as asymmetrical for the group, but S. Marshall now indicates (in. litt.) that some exceptions occur.

The epandrium of *Borboroides* always has a strongly sclerotized **anteroventral bridge** isolating the ventral genitalic structures from the intersegmental membrane. In *B. parva* the anteroventral bridge is very narrow but well sclerotized (Fig. 96, avb).

Many heteromyzid taxa have a horseshoe-shaped or

ring-like hypandrium or apparent variant thereof, which is continuous in front of the base of the aedeagus but is sometimes open posteriorly, with paired processes, often termed gonites, arising laterally or posterolaterally. Such taxa include *Austroleria truncata* McAlpine, *Amphidysis hesperia* McAlpine, and *Waterhouseia cyclops* Malloch (see D. McAlpine, 1985). In *Borboroides* there is usually no horseshoe-shaped structure but there is a more or less transverse sclerite on each side between the base of the aedeagus and each lateral margin of the epandrium, which I term the **lateral hypandrial sclerite**. In *B. parva* the hypandrial region is continuously sclerotized across the front of the aedeagal base.

In most *Borboroides* species there is a setulose process on each lateral hypandrial sclerite, which I term the **gonite** (see Figs 58, 84, 129g). In view of the instability in the presence and number of paired hypandrial processes in the Schizophora, I have no confidence in the homology of gonites (including pregonite, postgonite, inner and outer gonites) from family to family, or even within certain families (e.g., Coelopidae, Teratomyzidae, Neurochaetidae). A typical gonite is absent in *Borboroides doreenae* and in the genus *Heleomicra*.

The modification of the hypandrial region in *Borboroides* produces a generally extensive membranous zone between the base of the aedeagus and the anteroventral bridge of the epandrium. This is termed the **prehypandrial membrane**. It is often furnished with short microtrichia, discernible only at high magnifications, which may be grouped into short, comb-like rows, but these are absent in *B. parva* and *B. menura*.

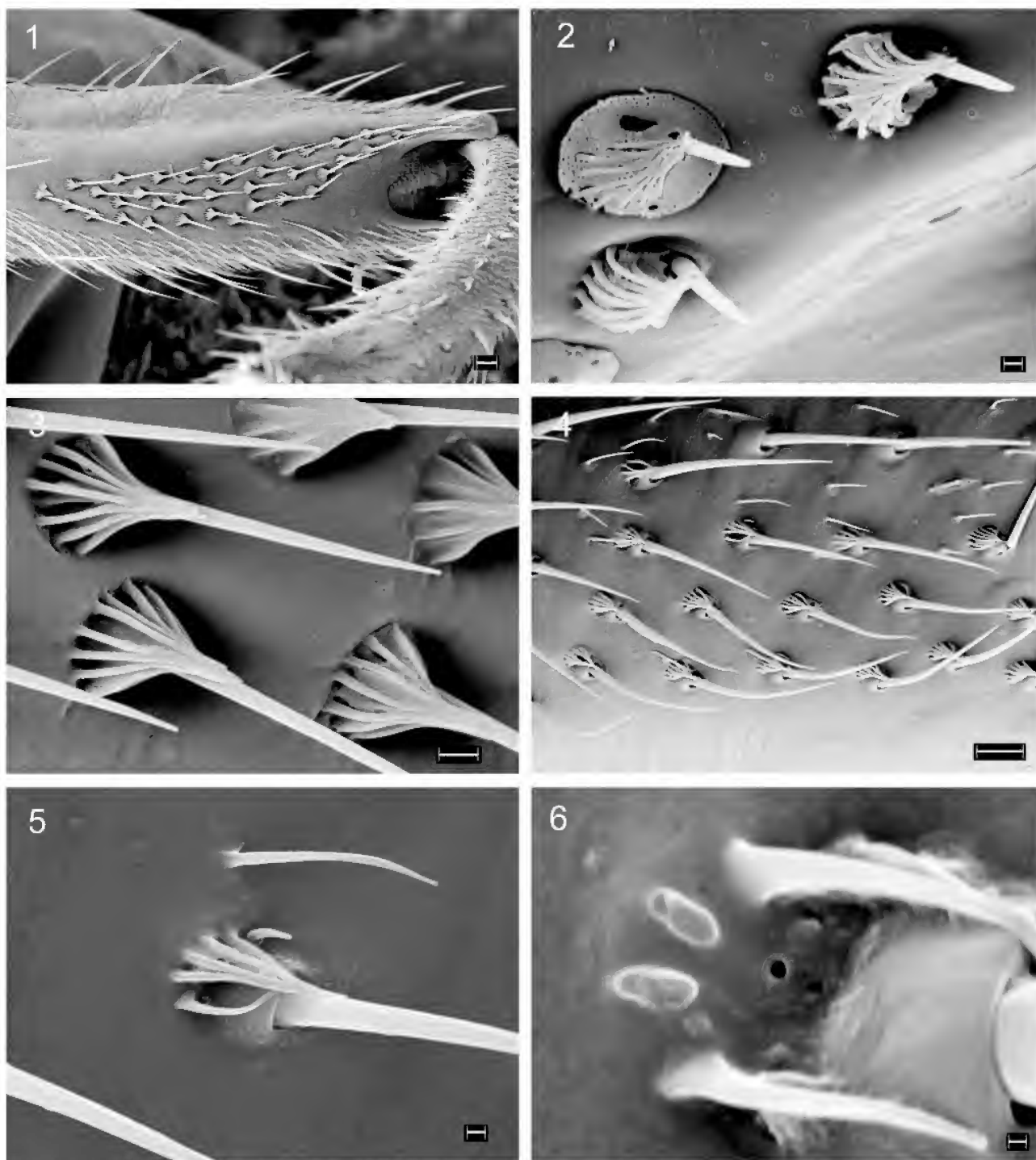
The aedeagal apodeme is often long in *Borboroides*, and in some species the anterior end is connected to the anteroventral bridge of the epandrium; in others it is quite free from other sclerites anteriorly.

The paired **cerci** of the male are very diverse in the Borboroidini, and very often have a shape or armature distinctive for the species. Typically each cercus is articulated with the posterodorsal margin of the epandrium by a membranous line (Fig. 146) and each is joined to the other of the pair by a slender basal sclerotized strip (Fig. 145). In *Borboroides atra* the cercus is sclerotically continuous dorsally with the epandrium (Fig. 149). In *B. menura* the enlarged cerci are almost fused into a stout basal body showing a median posterior membranous seam, but distally form a pair of long lobes (Fig. 99).

Hind femoral gland-baskets

The ventral surface of the hind femur in most *Borboroides* spp. shows under SEM a taxonomically variable arrangement of groups of microtrichia and macrotrichia, generally associated with a smaller number of cuticular pores. The pores appear to produce a secretion from subcuticular glands, which secretion often solidifies, and, in dried specimens may congeal on the adjacent cuticle or microtrichia. I use the term gland-basket for such a group of trichoid hairs associated with one or more such pores. Gland-baskets are only known to me in species of *Borboroides*, and are apparently absent in other heteromyzids examined, including *Heleomicra* spp., though a thorough survey has not been made.

I describe and illustrate the principal gland-basket patterns, beginning with the distinctive type seen in *Borboroides doreenae* and *B. helenae*, which first drew my attention to these structures. I have not had the opportunity

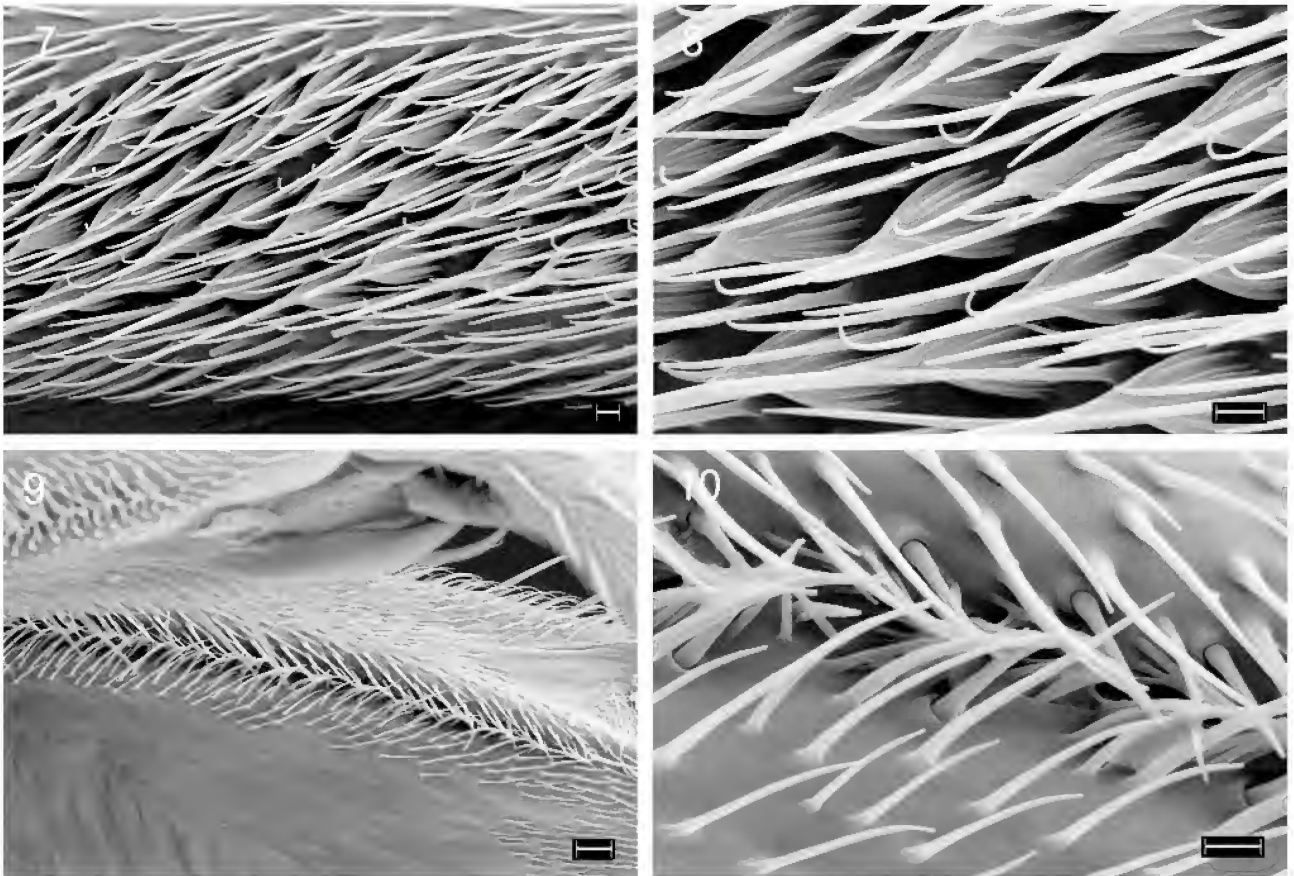


Figs 1–6. (1) *Borboroides doreenae*, female, part of right hind femur showing gland-baskets; scale = 10 μ m. (2) *B. doreenae*, three gland-baskets with concavities filled with solidified secretion; scale = 1 μ m. (3) *B. doreenae*, several gland-baskets showing microtrichia coated with solidified secretion; scale = 2 μ m. (4) *B. helena*, part of posteroventral surface of hind femur, showing gland-baskets; scale = 10 μ m. (5) *B. helena*, detail of gland-basket; scale = 1 μ m. (6) *B. helena*, gland-basket with two microtrichia removed to expose secretory pore; scale = 300 nm.

to examine all types in equal detail.

Borboroides doreenae (Figs 1–3). The ventral surface of the distal half of the hind femur bears a number of minute separate baskets (28 in one, 35 in another femur, from each of the two studied females) arranged irregularly in a longitudinal zone (Fig. 1). This zone is well differentiated, without other trichose hairs or obvious surface structure. Under high magnification each basket unit is seen to

consist of a shallow, rounded oval depression, with one long macrotrichium or setula on its distal margin, and an incomplete circlet of smaller marginal microtrichia, often with a few additional microtrichia within the circlet. The microtrichia in each unit are apically convergent so as to give the impression of a subconical basket. The length of the macrotrichium ranges from c. 10 μ m to 20 μ m, there apparently being variation both between individual (female)



Figs 7–10. (7) *Borboroides menura*, part of posteroventral surface of hind femur, showing many gland-baskets; scale = 3 μm . (8) Detail of same gland-baskets, showing many microtrichia cohering through secretion; scale = 3 μm . (9) *B. gorodkovi*, part of hind femur showing posteroventral tract of convergent microtrichia covering glandular groove; scale = 10 μm . (10) Detail of glandular groove of same showing macrotrichia (socket-based) and microtrichia of various types; scale = 3 μm .

flies and between the major microtrichia on the one femur. The microtrichia are somewhat less to distinctly more than half as long as the macrotrichium, but are much more slender (c. 0.4–0.5 μm in diameter near their bases).

There is general evidence in the dried examples examined of a secretion, now solidified, within the depression or within the basket. This material is clearly not a result of external contamination, as it is present only within the limits of each basket and the surrounding cuticle is clean. Sometimes it has filled the depression to overflowing and has formed a plug (as in Fig. 2), which may be solid or crumbled, or it may flow over the surface of the microtrichia, causing them to adhere together (Fig. 3). The presence of a secretion presumably means that there is a cuticular pore inside the basket (observed in other species) and a gland below the cuticle. Such a pore has not been located in *B. doreenae*, because of concealment by the microtrichia or by solidified secretion or by both.

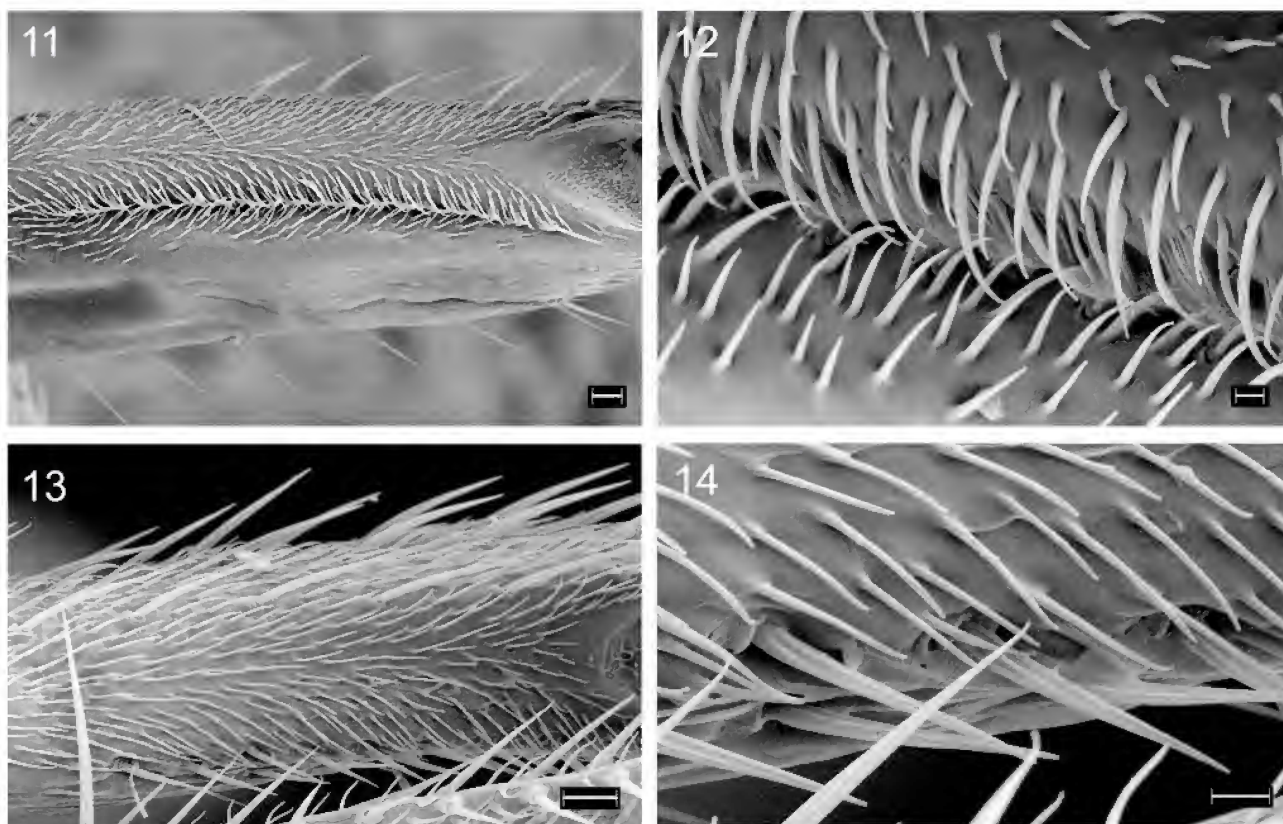
Borboroides helenae (Figs 4–6). The zone of gland-baskets is situated on the posteroventral surface of the greater part of the length of the hind femur, and few extraneous microtrichia are scattered through the zone. Otherwise general structure resembles that of *B. doreenae*. The macrotrichium of each basket is larger than in *B. doreenae*, often c. 32 μm long. Where the microtrichia of a basket complex are partly removed by abrasion, a distinct pore of c. 1 μm in diameter is apparent on the enclosed area of cuticle (Fig. 6).

Borboroides menura (Figs 7, 8). The glandular field is

restricted to a broad, longitudinal band on the ventral surface of somewhat less than the distal half of the hind femur. Within this zone the basket complexes are more numerous and crowded than in *B. helenae* and *B. doreenae* (at least 40 present in examined specimen), but they are rendered less conspicuous because they are interspersed with many longer surface microtrichia which cause the zone to appear densely pilose. Each basket unit resembles that of *B. doreenae*, except that the associated macrotrichium of each is distally attenuated and curved (to a much greater extent than the interspersed microtrichia). Though the surface of the femur has many macrotrichia (setulae), these are absent within the glandular field.

Borboroides gorodkovi and *B. fimbria* (Figs 9–12). In these species of the *atra* group the basket-bearing surface is located in a longitudinal posteroventral groove on the femur, but the groove is somewhat concealed by a band of numerous microtrichia which have their apices converging to simulate a ridge. Within the groove are less numerous macrotrichia, often smaller than the major microtrichia and sometimes forming a double series among the latter. Some much smaller basket-like groups of microtrichia are also present in the groove, and there is usually evidence of solidified secretion in the dried specimens.

The above structure is probably similar for most species of the *atra* group, other than *B. menura*. *Borboroides atra* is not quite typical of the group, as the longitudinal groove is usually roofed over by microtrichia on its anteroventral side only.



Figs 11–14. (11) *Borboroides fimbria*, part of left hind femur, showing posteroventral tract of microtrichia covering glandular groove; scale = 10 μm . (12) Detail of glandular groove of same; scale = 2 μm . (13) *B. parva*, part of ventral surface of left hind femur showing many microtrichia and larger macrotrichia; scale = 10 μm . (14) Detail of same showing microtrichia and posteroventral macrotrichia, apparently with some adhering secretion; scale = 3 μm .

Borboroides parva (Figs 13, 14). The ventral surface of the hind femur shows a general vestiture of numerous microtrichia. The cuticle between these may show a coating as of a secretion, but not enough material has been examined to exclude the possibility that this is due to external contamination. There are no basket-like structures on the femur, but some macrotrichia of the irregular posteroventral series are located in separate concavities or shallow rounded pits, which may contain solidified secretion.

The *perkinsi* and *stewarti* groups of *Borboroides* (Figs 15–21). The hind femur has no basket-like tufts of microtrichia, but there is a broad specialized posteroventral zone occupying c. the distal half of the femur. This also includes numerous, irregularly placed macrotrichia, which have prominent or tubercle-like sockets, and a pore may be visible at the base of the socket or within the hollow of the socket. The trichoid hairs are commonly matted by solidified secretion in our dried material. The female of *Borboroides stewarti* has on the hind femur, in addition to the specialized posteroventral zone, an apical dorsal zone bearing dense microtrichia of two types. The smaller, more numerous ones are strongly curved, and the larger ones are much thicker and basally incrassate (Figs 20, 21). The cuticle of this zone appears to be roughened, but it is not clear if it is coated with a secretion. Other species have not yet been examined for such zones.

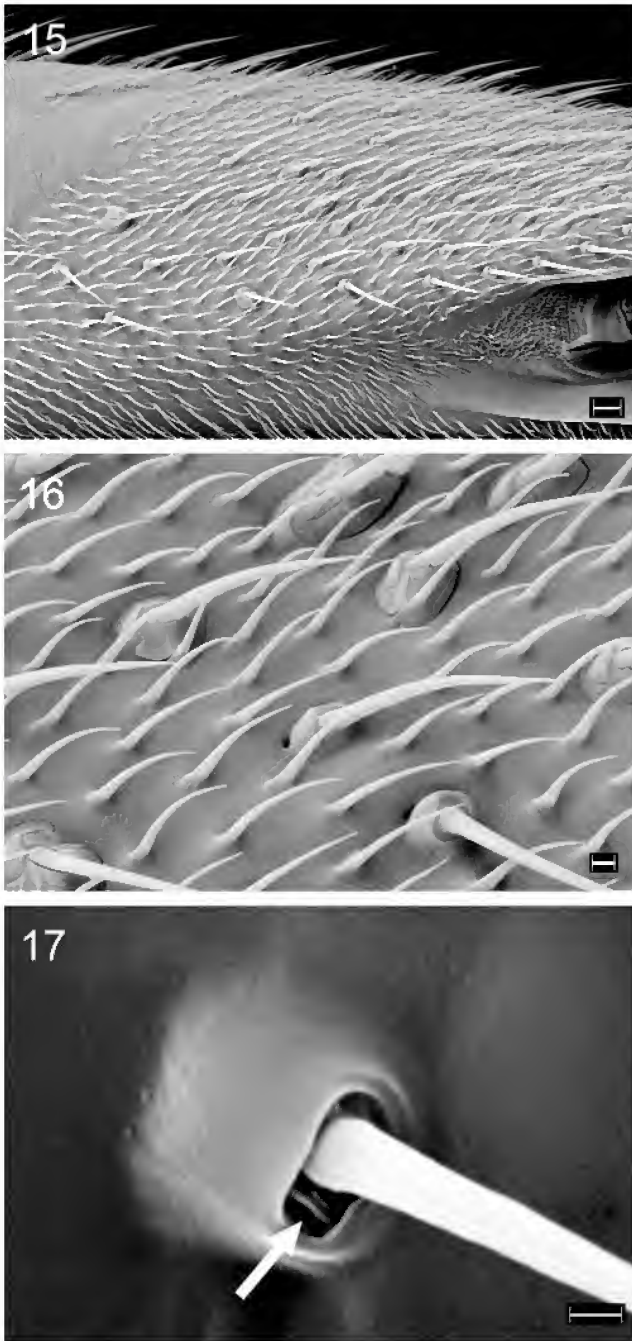
In *Borboroides dayi* and *B. staniochi* the hind femur apparently lacks basket-like structures, in contrast to *B. doreenae* and *B. helenae*, which they resemble in some other

respects. A fuller description of the hind femoral structures of these species should be based on new material.

Function of gland-baskets. In the lack of any experimental investigation or more detailed study of structure, it is not possible to attribute a function to gland-baskets with any strong degree of probability. Any sexual function seems unlikely because of the apparent lack of sexual dimorphism. As many flies clean the wings with the hind legs, it is possible that the secretion is used in grooming. Production of a chemical deterrent or inhibitor to parasites or predators is also possible, perhaps in conjunction with grooming behaviour.

Stridulatory organ in *Borboroides musica*

In this species only, the fore coxa and fore femur of both sexes are co-adapted to produce what I interpret to be a sound-producing mechanism or stridulatory organ (Fig. 22). The fore coxa (Fig. 23) has peg-like processes (apparently thickened microtrichia) in a longitudinal band near the anterior margin of the explanate outer surface. The base of the femur has a modified area of cuticle (Fig. 24) bearing bands of many closely placed parallel ridges. These ridges intergrade with short microtrichia (pruinescence) at the margins of this area. The intergradation series includes decumbent microtrichia, microtrichia which become partly fused by one side to the cuticular surface, microtrichia in which the fused section lengthens into a ridge with only the finely pointed apex free, and complete surface ridges without free apices (see Fig. 25).



Figs 15–17. (15) *Borboroides musica*, distal part of hind femur, posteroventral view; scale = 10 μm . (16) Detail of same showing bases of macrotrichia coated with secretion; scale = 2 μm . (17) Clean base of one macrotrichium of same, apparent pore opening indicated; scale = 1 μm .

The modified surfaces of the coxa and femur are positioned so that they rub against each other when the leg is flexed at the trochanter. It is assumed that the peg-like processes of the coxa scrape against the seriate ridges on the femur to produce a sound in a similar operation to that of the guiro, a Latin American musical instrument.

Delimitation of Heteromyzidae

I previously gave a “list of characters typical of the Heleomyzidae.” After further consideration of heteromyzid morphology and that of feasible outgroups, I am now prepared to hypothesize a set of groundplan conditions or character states for the Heteromyzidae, a taxon thought to approximate to a monophyletic group, though with some doubts as to its precise delimitation (Table 1). With this groundplan set down, it becomes possible to test to some degree the likelihood of more derived taxa belonging within the family.

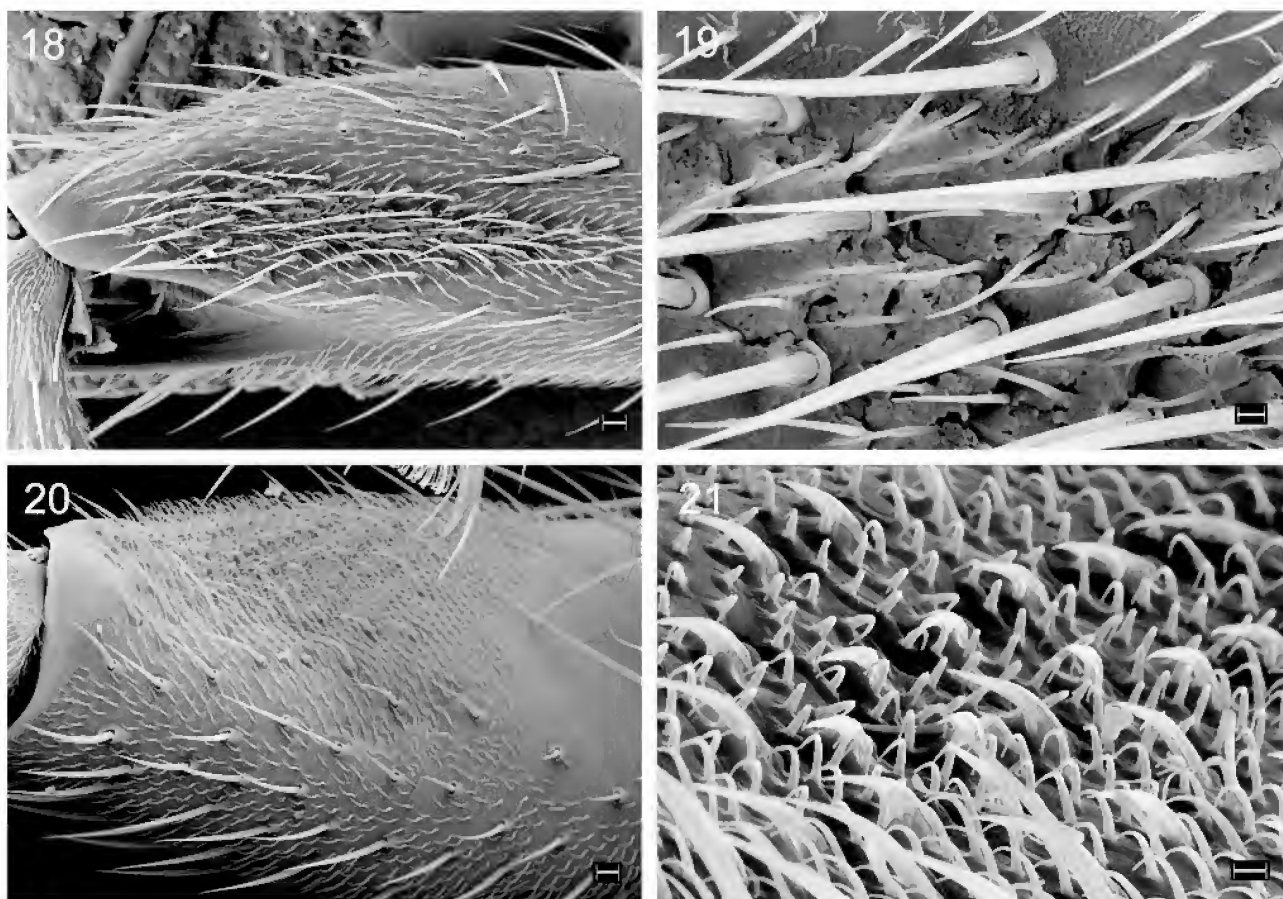
Doubtfully heteromyzoid taxa—Chyromyiidae and Mormotomyiidae

Though now generally given family status, the Chyromyiidae have been associated with Heleomyzidae or Trixoscelididae (e.g., Czerny, 1927) or conjectured to be the sister group to the Sphaeroceridae (J. McAlpine, 1989). My reason for excluding the chyromyiids from the Heteromyzidae is that there is not enough evidence to connect them, the morphological gap being just too great compared with that separating either the trixoscelidines or the sphaerocerines from other heteromyzid taxa.

Admittedly the heteromyzid genera *Neorhinotora* Lopes and *Waterhouseia* Malloch are also very different from what may be considered as core heteromyzids, but for these examples there are related taxa forming a link to such core taxa. For example, the genera *Anastomyza* Malloch, *Apophoneura* Malloch and *Rhinotoroides* Lopes form a morphological chain connecting *Neorhinotora* to less derived genera, while *Waterhouseia* shows points of resemblance to the tribe Fenwickiini of New Zealand. For the Chyromyiidae any such link is missing.

The difficulty in placement of the Chyromyiidae is reflected in the vacillating views of Hennig, who, in 1965, considered that the Chyromyiidae and Aulacigastridae were perhaps sister groups, but later (1973), in a less committal classification, separated the former more widely from both Aulacigastridae and Heleomyzidae-Trixoscelididae.

The little known monotypic African family Mormotomyiidae has been considered to be related to the Heleomyzidae and Sphaeroceridae (e.g., by J. McAlpine, 1989), but its true relationships are probably with the calyptrates (Muscoidea sensu Colless & D. McAlpine, 1991). If the position of the preabdominal spiracles in the tergites is not considered a groundplan condition of the Muscoidea, then I can find no character state which aligns the Mormotomyiidae with the Heteromyzoidea rather than the Muscoidea (or calyptrates). *Mormotomyia hirsuta* Austen (see particularly van Emden, 1950) has an extensively hirsute condition obscuring its basic chaetotaxy, but it still appears to show some differentiation of seriate incurved lower fronto-orbital bristles or frontal bristles, in addition to a schizometopous postfrons. The deeply cleft antennal segment 2 excludes it from the Heteromyzoidea, in my opinion. Hennig's (1973) latest treatment of this problem placed Mormotomyiidae as a possible sister group to the rest of the calyptrates.



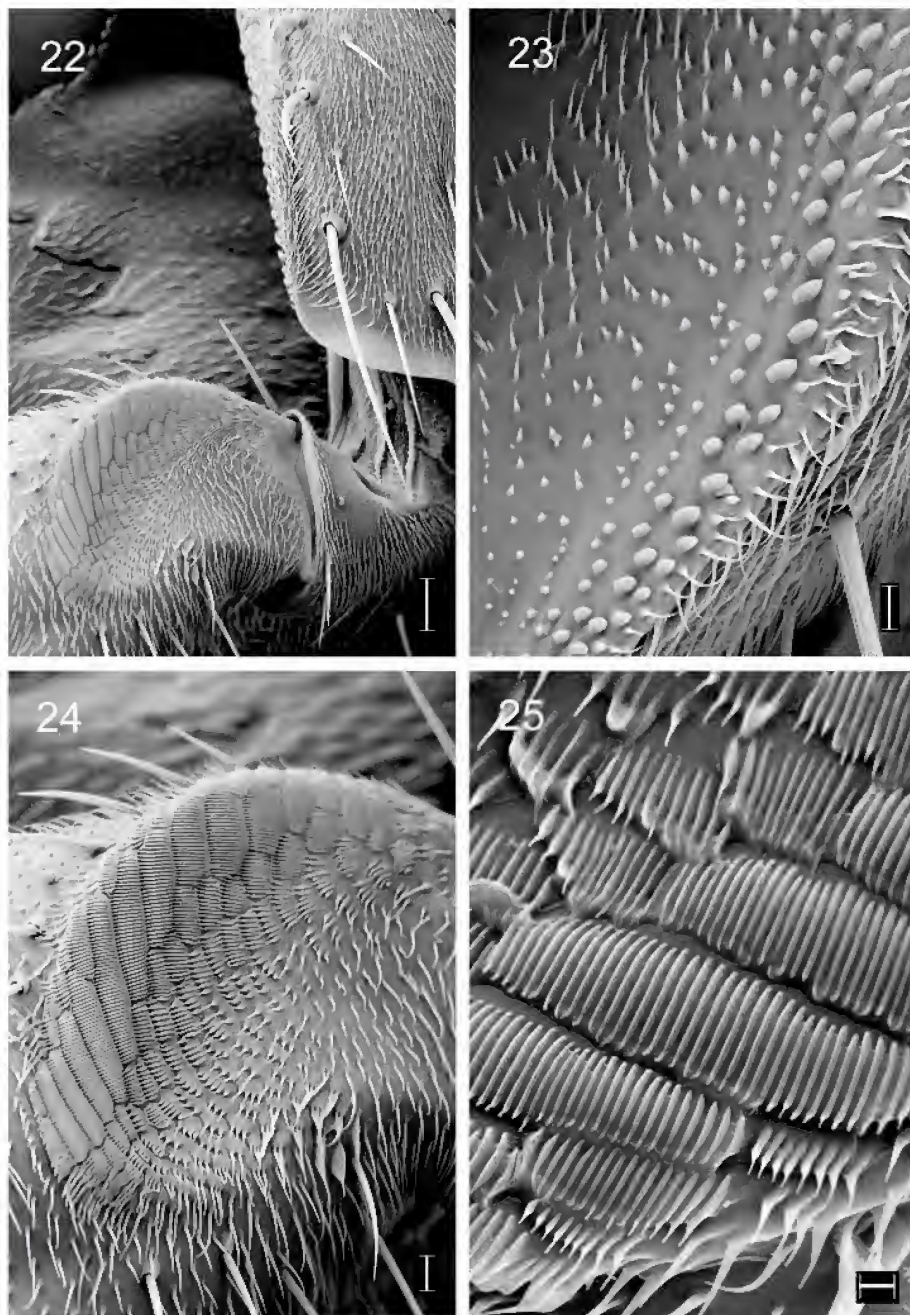
Figs 18–21. (18) *Borboroides perkinsi*, distal part of hind femur, posteroventral view showing specialized group of macrotrichia interspersed with microtrichia; scale = 10 μ m. (19) Detail of specialized zone of same, cuticle encrusted with solidified secretion; scale = 2 μ m. (20) *B. stewarti*, female, distal part of hind femur, posterodorsal view, showing specialized dorsal zone; scale = 10 μ m. (21) Detail of dorsal zone of same, showing two types of microtrichia; scale = 3 μ m.

Subfamily classification

The most comprehensive classification of “heleomyzid” taxa divides them into 22 tribes (D. McAlpine, 1985), and I still believe that most of these tribes are likely to be monophyletic. I give here a very preliminary attempt at a subfamily classification for the Australasian taxa of Heteromyzidae. Non-Australian groups which may need subfamily status are not treated here. This is an extension of my previous tribal classification, and groups the “heleomyzid” tribes of Australasia together with the sphaerocerines (formerly Sphaeroceridae) into seven subfamilies, four of which are further divided into tribes. Working only from comparative morphology, I have not achieved a strongly supported result at this stage, but I believe that, with production of modern systematic catalogues, there is a demand for a more hierarchical classification, even though this may be subject to much revision as the result of any future molecular studies.

(1) Subfamily Heteromyzinae. This is coextensive with the tribe Heleomyzini as characterized and delimited by D. McAlpine (1985). It is the equivalent of the family Heleomyzidae less the tribe Borboropsini and the subfamily Suilliinae of Gorodkov (1984). The taxonomic diversity of the subfamily probably calls for a division into tribes, but the divisions used by Gorodkov (1984) may need some reworking.

It has been suggested that the Holarctic genera *Borboropsis* Czerny and *Oldenbergiella* Czerny are closely related or perhaps synonymous (Mathis, 1973), but my study of both genera does not support this, and I note that Gorodkov (1984) placed the genera in separate tribes after study of postabdominal morphology. The superficial resemblance is due to reduction in some aspects of chaetotaxy which can be expected with such marked reduction in size (as noted below for *Borboroides parva*, the smallest species of Borboroidini), and is likely to be convergent. In both genera these attributes are superimposed on a plesiomorphic general morphology. However, while *Oldenbergiella* has the apomorphic facial structure that characterizes the Heteromyzinae (D. McAlpine, 1985 as Heleomyzini), *Borboropsis* has a more generalized and probably plesiomorphic facial structure, and should probably be referred to a separate subfamily, the Borboropsinae. Papp (1998b) described the “family Borboropsidae” (his treatment of the Borboropsini or Borboropsinae) as having “face strongly concave (Fig. 48), medial part weakly sclerotized.” The treatment of the face in his fig. 48 (head of *Borboropsis puberula* [Zetterstedt]) is uninformative. My own study of the species *B. puberula* (material in OX) and *B. steyskali* Mathis (in AM) confirms that, as given above, the face is uniformly sclerotized with everted, sharply defined lower margin, and that Papp’s statement seems to be a misinterpretation. I have not seen *Nidomyia* Papp, 1998a, but I point out that his elevation of



Figs 22–25. *Borboroides musica*, stridulatory modifications of fore leg. (22) Parts of right coxa, trochanter, and femur, inner surface view; scale = 30 μm . (23) Part of coxa, outer surface showing band of peg-like microtrichia; scale = 10 μm . (24) Basal part of fore femur showing zone of modified microtrichia; scale = 10 μm . (25) Detail of ridge-like microtrichia of same; scale = 3 μm .

this taxon to a second tribe (Nidomyiini) of one genus and species in the Borboropsinae added pointless nomenclature without contributing to hierarchical classification. The differences between these two borboropsine tribes in male postabdominal morphology, as given by Papp (1998b), are no greater than those between certain species in the *atra* group of *Borboroides*.

(2) Subfamily Diaciinae. This was previously characterized as the tribe Diaciini (D. McAlpine, 1985). As I have no convincing evidence as to the relationships of this group, I simply raise the tribe to subfamily rank.

(3) Subfamily Tapeigastrinae. This was previously characterized as the tribe Tapeigastrini (D. McAlpine, 1985).

My further studies show that the previously unknown male of *Ollix* McAlpine, has a much reduced tergite 6, like that of *Tapeigaster* Macquart and unlike that of the Diaciinae.

(4) Subfamily Cnemospathidinae. This is a new concept combining seven south-temperate tribes on the evidence of a single probable synapomorphy and some cross-resemblances between tribes. The synapomorphic condition is the gibbosity of the anatergite (superior pleurotergite) close to its upper border with the katatergite (inferior pleurotergite). This condition includes the “allophylopsine type of pleurotergite” of D. McAlpine (1985), but is more broadly defined and includes a range of surface contours. The broadly defined condition occurs in the

tribes Zschaetomyiini, Allophylopsini, Cnemospathidini, Epistomyiini, Borboroidini, Notomyzini, and perhaps Blaesochaetophorini, all otherwise as characterized by D. McAlpine (1985). In other heteromyzid groups and most other schizophoran families, the anatergite shows general slight convexity, but no particular gibbosity next to the katatergite. The difference may seem slight, but is demonstrable through the heteromyzid taxa examined. Because this distinction is somewhat differently defined from that between my allophylopsine and rhinotorine types of pleurotergite (D. McAlpine, 1985), I no longer use these terms.

In most tribes of Cnemospathidinae there is a large subapical posterior bristle, which is not one of a series, on the mid femur. This bristle is particularly conspicuous in the Zschaetomyiini, Allophylopsini, Cnemospathidini, and Epistomyiini. It is often accompanied by a smaller dorsal to posterodorsal subapical bristle. In the Notomyzini and Blaesochaetophorini the subapical posterior bristle is commonly a little smaller, but usually still quite obvious. In the Borboroidini such a bristle is generally small or little differentiated, but in a few species (e.g., *Borboroides menura* and particularly *B. dayi*) it is more developed, though smaller than in the Allophylopsini etc. Some taxa of Sphaerocerinae have a somewhat similar subapical bristle on the mid femur (numerous examples in the Copromyzini and Limosinini), but those which I have observed are definitely posterodorsal in position, in contrast to the posterior subapical bristle of typical Cnemospathidinae. It is therefore doubtful if this is a homologous bristle through both subfamilies. In species of several other heteromyzid subfamilies subapical, more or less posterior bristles occur on the mid femur, but these usually form a transverse or oblique series, or are little differentiated, or correspond less precisely in position to that of more typical Cnemospathidinae.

The absence without trace of vein 7 (2A or A₂) beyond the alular incision is an apomorphic state of the Cnemospathidinae, which distinguishes them from Australian taxa of the three preceding subfamilies, in addition to the non-Australian Borboropsinae and Suilliinae. However, this apomorphic condition is shared with the three following subfamilies (Sphaerocerinae, Rhinotorinae, Trixoscelidinae).

The Zschaetomyiini resemble certain taxa of the Diaciinae in some characters, but those of the arista, pleurotergite, and subapical posterior bristle of the mid femur agree only with the Cnemospathidinae.

In setting up the tribe Borboroidini to contain the two superficially similar Australian genera *Borboroides* and *Heleomicra* (D. McAlpine, 1985), I had difficulty in finding distinctive shared apomorphic character states in support of this association. In general characters the Borboroidini closely resemble the tribe Notomyzini (only genus *Notomyza* Malloch) and to a smaller extent the tribe Cnemospathidini, both native to southern South America.

In the Borboroidini, Notomyzini, and Cnemospathidini the section of the costa on the marginal cell (between veins 1 and 2) has longitudinal series of rather fine setulae (two to four rows in Borboroidini, four rows in available material of Notomyzini and Cnemospathidini), but no thicker spinules or larger spines. This is in contrast to other tribes of the subfamily Cnemospathidinae, in which the setulae on this part of the costa are accompanied by seriate spinules and/or spaced spines. The Cnemospathidini differ from the

Borboroidini in the larger subapical posterior bristle on the mid femur, the more allophylopsine-like pleurotergite, the pair of long spines or stout bristles on the costa on the basal side of the subcostal break, the two large sternopleural bristles, the surstylus generally (?always) not articulated with the epandrium, and the characteristic very elongate, flexible aedeagus (unlike any of the diverse types in the Borboroidini).

In the Notomyzini the mid tibia has one large preapical dorsal bristle, whereas the Borboroidini have two such bristles (*Borboroides*) or none (*Heleomicra*). This distinction is of diagnostic rather than phylogenetic significance. An apparent groundplan apomorphy for the Borboroidini (possible synapomorphy for *Borboroides* and *Heleomicra*) is the reduction of tergite 6 in the male (small or absent, lacking setulae), in contrast to the large, setulose tergite 6 of Notomyzini (Malloch, 1933; D. McAlpine, 1985). In contrast, sternite 8 is large and often complex in males of Borboroidini, but it is absent, so far as is known, in males of Notomyzini. However, the much reduced male tergite 6 of the Borboroidini does not provide a distinction from certain other tribes of the subfamily Cnemospathidinae, probably all of which have a large sternite 8 (D. McAlpine, 1985). The Borboroidini have the prosternum broadened anteriorly, unlike that of the Notomyzini, which is somewhat narrowed. It is difficult to assign a phylogenetic polarity to these two character states.

(5) Subfamily Sphaerocerinae. This subfamily is coextensive with the family Sphaeroceridae of recent authors (e.g., Roháček, 2001), here given new status for reasons discussed above. The tribes Tucmini, Copromyzini, Sphaerocerini, Homalomitriini, and Limosinini correspond, with revised status, to the five subfamilies used by Roháček *et al.* in their world catalogue. Only the tribes Copromyzini, Sphaerocerini, and Limosinini live in Australia, and probably only the last includes native taxa. See Richards (1973) for a somewhat out of date treatment of the Australian fauna.

(6) Subfamily Rhinotorinae. This is a new concept combining the tribes Nephellini and Rhinotorini as characterized by D. McAlpine (1985). It is characterized mainly as follows: ptilinal suture ventrolaterally not extending to vicinity of vibrissa, usually terminating not far from lower eye margin; lower margin of face generally broadly prominent; central cheek bristle well developed, except in Australasian taxa; antenna more or less correct, with rounded segment 3; prelabrum generally anteriorly prominent; labella of proboscis much reduced; tibial bristles generally reduced; vein 6 discontinued well before wing margin; vein 7 beyond alula absent without trace.

Only the tribe Rhinotorini is represented in Australasia. The genus *Zinza* Sinclair & D. McAlpine, 1995, has been added since my previous (1985) review.

(7) Subfamily Trixoscelidinae. This newly delimited concept includes the tribes Trixoscelidini, Fenwickiini, and Waterhouseiini as characterized by D. McAlpine, 1985. The tribe Pentachaetini of McAlpine, 1985, perhaps also belongs in this subfamily. Features common to most included taxa are: setulae on anterior part of postfrons few and minute or absent (except in Pentachaetini); mesopleuron setulose and usually with posterior bristle (bare in Pentachaetini); hind basitarsus generally long and slender (except where modified in males of some Trixoscelidini); costa with spaced anteroventral spines or enlarged bristles between subcosta

and vein 2 (except in Waterhouseiini and Pentachaetini). The wide separation of the ocellar bristles outside the ocellar triangle is not a consistent feature either of the Trixoscelidinae or of the Trixoscelidini.

The tribes Fenwickiini, Waterhouseiini, and Pentachaetini live in Australasia, but the first is endemic to New Zealand.

Key to Australian non-sphaerocerine genera of Heteromyzidae

- 1 Vein 7 visible as a crease in membrane beyond alula; vein 6 usually extending to wing margin or almost so, though faint apically 2
 — Vein 7 absent; vein 6 variable in length, but not reaching margin 6
- 2 Scutellum bare, except for 2 pairs of marginal bristles 3
 — Scutellum haired or setulose 4
- 3 Face uniformly sclerotized across whole width on upper part, where it is deeply excavated; subcosta and vein 1 not distinctly divergent distally; pteropleuron bare; antennal segment 5 (preapical segment of arista) subglobose *Ollix* McAlpine
 — Face with pair of sclerotized lateral plates separated by a desclerotized or weakly sclerotized median strip; subcosta and vein 1 strongly divergent distally; pteropleuron setulose; antennal segment 5 cylindrical *Pseudoleria* Garrett
- 4 One or two pairs of dorsocentral bristles present; all femora with thick ventral spines; face uniformly sclerotized *Tapeigaster* Macquart
 — Four or more pairs of dorsocentral bristles present; femora without such spines, though often with ventral bristles; face not uniformly sclerotized 5
- 5 Lateral facial plates forming a pair of deeply concave oval pits on upper part of face, not extending to near vibrissae; four or more upper sternopleural bristles in a horizontal series *Amphidysis* McAlpine
 — Lateral facial plates not forming such pits, reaching narrowly to level of vibrissae; one strong upper sternopleural bristle present *Oecothea* Haliday
- 6 Hind basitarsus very short and stout (compared with fore basitarsus) and often otherwise modified; interfrontal bristles usually set in pair of regular longitudinal series; prosternum narrow-linear (except in some taxa with reduced wings) [most Australian native species with second basal and discal cells confluent, some with wing reduced or absent; see Richards, 1973] subfamily Sphaerocerinae
 — Hind basitarsus slender or not much differentiated from fore basitarsus; interfrontal bristles, if distinct, usually not placed in pair of regular longitudinal series; prosternum not linear, though often longer than wide; wing always well developed with separate second basal and discal cells 7
- 7 Mid tibia with one to three anterior bristles (in addition to any near apex) and a pair of approximated preapical dorsal bristles; costa, beyond end of vein 1, without spaced spines *Borboroides* Malloch (part)
 — Mid tibia without anterior bristles, except for the apical to subapical spur; other characters variable 8
- 8 Mesopleural bristle well developed; three strong reclinate fronto-orbital bristles present; postfrons of male narrowed; preapical dorsal tibial bristles absent *Waterhouseia* Malloch
 — Mesopleural (anepisternal) bristle absent or weakly differentiated from setulae; one or two fronto-orbital bristles present; postfrons of male not narrowed; preapical dorsal tibial bristles present or absent 9

9	One or two dorsocentral bristles present	10
—	Three to five dorsocentral bristles present	14
10	Subcosta incomplete, not nearly reaching costa distally; wing without markings; size minute	11
—	Subcosta complete; wing with few to many brown spots; size often larger	12
11	Anal cell open distally (Fig. 92); costa normally with one outstanding bristle just beyond humeral crossvein; mid tibia with pair of approximated preapical dorsal bristles	<i>Borboroides</i> Malloch (part)
—	Anal cell closed (Fig. 163); costa without single outstanding bristle on section beyond humeral crossvein; mid tibia without preapical dorsal bristles	<i>Heleomicra</i> McAlpine
12	Vein 4 bent forward apically to terminate very near vein 3; marginal and submarginal cells without seriate spots; arista irregularly long-plumose; abdominal sternite 1 undivided, quadrate	<i>Zinza</i> Sinclair & McAlpine
—	Vein 4 not thus bent forward; marginal and submarginal cells each with a series of brown spots; arista with minute pubescence or almost bare; abdominal sternite 1 divided by median desclerotization	13
13	Vertex of head not excavated; vibrissa absent; mesopleuron bare	<i>Zentula</i> McAlpine
—	Vertex broadly excavated; vibrissa developed as the foremost member of a series of cheek bristles; mesopleuron setulose	<i>Cairnsimyia</i> Malloch
14	Mid tibia with one preapical dorsal bristle and no other bristles except the apical to subapical spurs; mid femur without anterior bristles; proepisternal bristle large, reaching to humeral callus; dorsocentral bristles 1+4	<i>Pentachaeta</i> McAlpine
—	Mid tibia with more than one bristle; mid femur with c. three or more stout anterior bristles on distal part; proepisternal bristle short and weak, often minute; dorsocentral bristles three or four	15
15	Some well-developed acrostichal bristles present in addition to the prescutellar pair; mid tibia with one preapical dorsal bristle and one or two posterodorsal bristles on distal third; section of costa just beyond vein 1 with slender setulae, but no spinules or spines	<i>Prosopantrum</i> Enderlein
—	At most only the prescutellar acrostichal bristle present; mid tibia with two approximated preapical dorsal bristles and no posterior bristles; section of costa beyond vein 1 with short spinules and often some larger spaced spines, in addition to slender setulae	16
16	Scutellum bare dorsally (except for two pairs of major bristles)	17
—	Scutellum setulose dorsally	18
17	Dorsocentral bristles 0+3; mesopleuron bare; wing with small markings on crossveins only	<i>Leriopsis</i> McAlpine
—	Dorsocentral bristles 1+2; mesopleuron setulose; wing with extensive blackish markings	<i>Trixoleria</i> McAlpine
18	Dorsocentral bristles 0+3; mesopleuron setulose; scutellum with fine ventral setulae below apex	<i>Austroleria</i> McAlpine
—	Dorsocentral bristles 1+3; mesopleuron bare; scutellum without such ventral setulae	<i>Diplogeomyza</i> Hendel

Genus *Borboroides* Malloch

Borboroides Malloch, 1925: 85. Type species (original designation) *B. atra* Malloch.

Description. Minute to moderately small flies (length of wing c. 1–5 mm), often of slender build, but some of smallest species relatively robust, of blackish to yellow-brown body colour; wing faintly pigmented, without darker markings.

Head. Postfrons usually with more or less proclinate setulae on anterior median part; frontal lunule at most narrowly exposed; ptilinal suture on each side ventrally extended towards vibrissa, well below level of lower margin of eye; face uniformly sclerotized, more or less concave in profile, but often with median region slightly convexly raised on upper part; cheek region (“gena”) with single series of peristomial setulae only; postvertical bristles markedly convergent; small paraverticlar bristle present between postvertical and outer vertical; ocellar bristle well developed; fronto-orbital bristles two (except when anterior one is much reduced), both close to eye margin, posterior one reclinate and, to variable degree, sloped outwards, anterior one reclinate, eclinate, or proclinate, sometimes vestigial or undifferentiated from adjacent setulae; vibrissa well differentiated; central cheek bristle absent. Antenna: segment 2 with distal articular surface facing obliquely downwards (least so in *B. doreenae*), with well-developed conus inserted into segment 3; segment 3 usually almost horizontally oval with oblique base fitted to segment 2, in *atra* group more nearly circular and slightly decumbent; segment 5 generally elongate, at least 4× as long as maximum diameter (less elongate in *B. doreenae*); segment 6 with many short hairs on entire length. Prelabrum in most species larger in female than in male; proboscis with moderately developed labella.

Thorax. Prosternum rather short, anteriorly broadened, but remote from propleuron on each side (broader than in general condition of Allophylopsini), without setulae; scutellum shorter than in Allophylopsini, without setulae; subscutellum variable in size and degree of convexity, generally less prominent and convex than in *Heleomicra*. Fore femur usually with seriate posterodorsal and posteroventral bristles; mid femur with seriate anterior bristles, which are sometimes rather small, in *B. parva* reduced to single distinct bristle; hind femur usually with one preapical anterodorsal bristle, usually without anterior and anteroventral bristles; fore and hind tibiae each with one preapical dorsal bristle or none; mid tibia with two more or less approximated preapical dorsal bristles and usually one to three longitudinally aligned slightly more basally located anterior bristles (absent in *B. parva*), also the following subapical spurs: one large anterior, often one smaller posterior, one ventral spur, latter often large, but absent in males of some species; hind tibia sometimes with anteroventral apical or subapical spur; mid basitarsus longer than other basitarsi; fore basitarsus of male without apicoventral process (present in such heteromyzid genera as *Borborillus* Duda; *Leriopsis* McAlpine, Fig. 167; *Pseudoleria* Garrett; and *Zachaetomyia* Malloch). Wing: costa with well-developed anterodorsal and anteroventral costagial bristles, with humeral break usually visible as a short, little sclerotized region, without spaced anterior or anteroventral spines among the numerous weaker setulae or spinules; subcosta well sclerotized for some distance beyond humeral crossvein, distally either not reaching

costa but terminating freely in membrane near vein 1, or traceable to costa but sclerotized to variable degree, often with visible weakening opposite humeral break of costa; fork of vein 2+3 slightly basad of basal extremity of discal cell; basal section of vein 4 at least 0.7× length of second section (before anterior crossvein); distal section of vein 6 not reaching wing margin as a visible trace, either long, short, or (in *B. parva* which has anal cell open distally) absent; vein 7 absent without trace beyond alular incision.

Abdomen. Sternite 1 subquadrate and well sclerotized, or reduced and sclerotized only at sides. **Male postabdomen:** tergite 6 quite small but usually distinguishable, without setulae; sternite 6 primitively sclerotized mainly on left side of postabdomen, with dark, sclerotized anterior marginal stripe, dorsally joined to compound protandrial sclerite, in *B. atra* and allied species becoming more or less symmetrical, with thickened marginal strip encircling postabdomen or almost so; segment 8 more or less lengthened and petiole-like (least so in *B. parva*), with sternite 8 extending round ventral surface as a sclerotized bridge; posterior extremity of sternite 8 generally with pair of lateral prominences for hinge-like articulation with epandrium; epandrium usually narrowed anteriorly, with contracted foramen connecting to protandrium, with sclerotized anteroventral bridge separated from hypandrial structures by window-like prehypandrial membrane; surstylus articulated with margin of epandrium; hypandrium of very diverse form and armature, without sclerotization anterior to base of aedeagus (except in *B. parva*); aedeagus variable, but never of the very elongate flexible type (as seen in *Prosopantrum* spp., Malloch, 1933), usually with long apodeme (shorter in a few species) unconnected to hypandrium; cerci usually separate, but often connected by narrow sclerotized strip. Female postabdomen moderately extensile; tergites and sternites 6 and 7 separately sclerotized, not spinose; cerci separate, ovoid or somewhat elongate; spermathecae three, with dark cuticularized vesicles, two of them sharing a common duct.

Distribution. Most less arid parts of temperate Australia; extending to tropics on Atherton Tableland, Queensland (*B. atra* Malloch). This is an addition to the tropical Australian “heleomyzid” records summarized by Sinclair & D. McAlpine (1995).

Notes

I have, over a long period, considered the problem as to whether the *stewarti* group (including six species) forms a sister group to the rest of the genus *Borboroides* as here constituted, and, if so, whether it should be separated as another genus. I think there is some evidence for the first proposition, as the presence of upwardly directed setulae on the mesopleuron (or anepisternum, see Fig. 81) in the other five species groups provides a distinctive synapomorphy. However, various other diversely distributed apomorphies cut across such a division, and the one species of the *perkinsi* group shows a combination of the wing characters, which strongly differentiate the *stewarti* group on one hand from the *stanoichi*, *helenae*, *parva*, and *atra* groups on the other. The wide diversity in certain male postabdominal characters does not particularly support the division into two genera, but various postabdominal and other characters strongly support monophyly of *Borboroides* s.l. as distinct from

Heleomicra; for example, the presence of the ventral bridge of sternite 8 and the anteroventral bridge of the epandrium is not known to me in other heteromyzid genera. For these reasons I maintain a broad genus *Borboroides* consisting of

six possibly monophyletic species groups.

The generic name is feminine, as originally treated by its author, under Article 3.1.4.4 of the ICZN (1999).

Key to species of *Borboroides*

- 1 Face almost entirely bare and glossy; arista largely white, yellow basally; dorsocentral bristles 1+2; mesoscutum without setulae (*perkinsi* group) *perkinsi* (p. 176)
- Face entirely pruinulent; arista brown to blackish; dorsocentral bristles 0+1, 0+2, or 0+3; mesoscutum setulose, at least on central part 2
- 2 Mesopleuron (anepisternite) without setulae; mid tibia with large posterior (as distinct from posteroventral) subapical spur; vein 5 almost straight where it borders on discal cell (Fig. 38); length of discal cell at least 3× distance of its posterodistal angle from margin measured in direction of distal section of vein 5 (*stewarti* group) 3
- Mesopleuron setulose (Fig. 102); mid tibia usually without posterior subapical spur; vein 5 usually distinctly curved outwards where it borders on discal cell (Figs 98, 104); length of discal cell much less than 3× distance of its posterodistal angle from margin 15
- 3 Females 4
- Males 9
- 4 Abdominal segment 5 reduced in size, forming part of retractile postabdomen (Figs 36, 37), with relatively small tergite; mid tibia always without ventral bristle other than subapical spur 5
- Segment 5 forming obvious part of ovoid preabdomen, its tergite almost as long as tergite 4; mid tibial armature variable 6
- 5 Anterior fronto-orbital bristle proclinate; mesopleuron thinly pruinulent, with glossy bare zone restricted to anteroventral quarter; mesoscutum tawny-yellow with median brown stripe narrowed anteriorly and sublateral postsutural brown mark; abdominal tergite 4 not margined; tergite 5 almost parallel-sided (Fig. 36) *musica* (p. 164)
- Anterior fronto-orbital bristle eclinate; mesopleuron with large glossy bare central zone, pruinulent posteriorly and anterodorsally; mesoscutum much more extensively brown to black, but partly fading in old specimens; abdominal tergite 4 margined, i.e. with groove parallel to lateral margin setting off convex marginal ridge; tergite 5 almost semicircular (Fig. 37) *donaldi* (p. 173)
- 6 Mesoscutum tawny-yellow, usually with median brown stripe and sublateral brown mark; mid tibia without ventral bristles except near apex *stewarti* (p. 162)
- Mesoscutum with more extensive black to dark grey coloration; mid tibia usually with one or more ventral bristles near or before mid-length 7
- 7 Prelabrum and lower part of occipital region brown to black; mid tibia with a series of 2 to 4 short ventral bristles in addition to subapical ventral spur; tergite 5 extensively dull, pruinulent, particularly on broad median zone and on lateral margins *danielsi* (p. 167)
- Prelabrum and lower half of occipital region yellow or tawny-yellow; mid tibia generally with one long ventral bristle in addition to subapical spur; tergite 5 largely glossy, pruinulent mainly on anterior and posterior margins 8

- 8 Anterior fronto-orbital bristle not more than half as long as posterior one, slightly reclinate; hind femur with only one anterodorsal bristle, in addition to any small subapical one; abdominal sternite 5 less than 1.4× as long as sternite 4, entirely densely pruinulent *tonnoiri* (p. 171)
- Anterior fronto-orbital bristle more than half as long as posterior one, slightly proclinate; hind femur usually with two longitudinally aligned anterodorsal bristles in addition to small subapical one; abdominal sternite 5 more than 1.5× as long as sternite 4, much of posterior third only thinly pruinulent and shining *lindsayae* (p. 169)
- 9 Mid tibia with long ventral mollisetae, many of them more than twice as long as tibial diameter (Fig. 52) 10
- Mid tibia with any mollisetae short and inconspicuous (Fig. 28) 11
- 10 Anterior fronto-orbital bristle reclinate and slightly sloped outwards, up to c. half as long as posterior one; intradorsocentral setulae in pair of paramedian series, with very few setulae between these and line of dorsocentral bristles; cercus with dense, conspicuous armature of bristles and mollisetae (Fig. 51) *tonnoiri* (p. 171)
- Anterior fronto-orbital bristle eclinate and slightly sloped forwards, c. two-thirds as long as posterior one; intradorsocentral setulae in two well-developed pairs of series; cercus with relatively sparse, inconspicuous setulae and mollisetae (Fig. 50) *lindsayae* (p. 169)
- 11 Hind tibia strongly curved and attenuated basally (Fig. 30); cercus small, with setulae short in single marginal series plus pair on dorsobasal prominence; mesoscutum tawny-yellow, with median brown stripe and sometimes pair of brown sublateral marks *stewarti* (p. 162)
- Hind tibia almost straight; cercus generally larger, with different arrangement of setulae; thorax variably marked, sometimes much darker than above 12
- 12 Anterior fronto-orbital bristle proclinate; cercus with conspicuous brush of long mollisetae; mesoscutum tawny-yellow with median and sublateral brown stripes *musica* (p. 164)
- Anterior fronto-orbital not proclinate; mollisetae on cercus less developed; mesoscutum of different coloration 13
- 13 Mesopleuron with large central bare glossy zone (pruinulent towards dorsal and posterior margins); middle dorsocentral bristle slightly shorter than anterior one (rarely vestigial) *donaldi* (p. 173)
- Mesopleuron densely pruinulent except near anteroventral angle; middle dorsocentral bristle about as long as anterior one 14
- 14 Entire occiput and prelabrum, and at least part of face and fore coxa brown to blackish; cheek less than half as high as eye; surstylus broad, less than twice as long as wide *danielsi* (p. 167)
- Lower occiput, prelabrum, face and fore coxa tawny-yellow; cheek c. half as high as eye; surstylus at least three times as long as width at mid-length probable variant of *lindsayae* (p. 169)
- 15 Anal cell open distally (Fig. 92); arista more than 1.5× as long as maximum diameter of eye; mid femur with only one well differentiated anterior bristle (Fig. 91); male: epandrium less than 0.13 mm long (*parva* group) *parva* (p. 187)
- Anal cell closed (Fig. 76); arista usually less than 1.5× as long as maximum diameter of eye; mid femur with a series of well differentiated anterior bristles; male: epandrium more than 0.22 mm long 16

- 16 Fronto-orbital bristles two large pairs, anterior one long, directed outwards (Fig. 109); abdominal sternite 1 well sclerotized on whole width; distal section of vein 6 usually less than twice as long as anal crossvein (*atra* group) 17
- Fronto-orbital bristles one large pair, sometimes also a much smaller reclinate anterior pair (Figs 65, 80); abdominal sternite 1 reduced, sclerotized mainly at sides; distal section of vein 6 at least twice as long as anal crossvein 27
- 17 Dorsocentral bristles three well-developed pairs; prescutellar acrostichal bristle developed; pleural region with narrow zone of dense grey pruinescence covering entire margin of fore coxal foramen; subapical anteroventral spur of hind tibia much longer than tibial diameter (Fig. 103); wing veins mostly yellowish *gorodkovi* (p. 193)
- Dorsocentral bristles usually one or two pairs; prescutellar acrostichal bristle undifferentiated or almost so; pleural region bordering fore coxal foramen shining, at least on upper part, with little pruinescence mainly towards lower part of foramen; subapical anteroventral spur of hind tibia generally not distinctly longer than tibial diameter, sometimes minute; wing veins brown 18
- 18 Dorsocentral bristles two, anterior one nearly as long as posterior one; section of costa on second costal cell with numerous setulae as long as or longer than width of cell; anal crossvein very oblique on large part, so as to make posterodistal angle of anal cell very obtuse; subapical anteroventral spur of hind tibia absent; male: cerci complex, fused basally, but forming pair of long, free distal lobes, the whole complex longer than epandrium (Fig. 99) *menura* (p. 190)
- Only one long (posterior) dorsocentral bristle present, any others quite small; section of costa on second costal cell with setulae all shorter than width of cell; anal crossvein almost transverse or slightly sloping distad posteriorly; subapical anteroventral spur of hind tibia usually distinct (vestigial in *B. merzi*); male: cercus much shorter than epandrium 19
- 19 Postfrons, including part in front of anterior ocellus, dull-pruinescent (Fig. 109); cheek c. half as high as eye; mesopleuron with very extensive posterior grey-pruinescent zone; male: protandrium stout, as broad as epandrium 20
- Postfrons with distinct, sometimes small, ovate to subtriangular glossy zone in front of anterior ocellus (Figs. 121, 140), or more extensively glossy; height of cheek usually less than half height of eye; mesopleuron with less extensive posterior pruinescent zone; male: protandrium usually more slender than epandrium, at least posteriorly from mid-length 21
- 20 Postfrons with black ground colour, sometimes tending dark brown anteriorly; cheek entirely black; palpus dark grey to black; male: fore tibia with anteroventral concavity near mid-length; surstylus (Figs 117, 118) basally transversely broadened, curved before mid-length, with slender almost straight distal section directed posteroventrally, without preapical gibbosity *corynetes* (p. 198)
- Postfrons partly black, with anterior margin yellow to orange-tawny, more conspicuously so in male; cheek yellowish anteriorly, at least in male; palpus yellow to yellow-brown; male: fore tibia without anteroventral concavity; surstylus (Figs 114, 115) somewhat variable with distal section not posteriorly inclined, typically with posterior preapical gibbosity *shippi* (p. 195)

- 21 Capitellum of halter grey-brown; male: surstylus with large anterior, outwardly inclined rounded tubercle at base (Fig. 149); cercus dorsally fused to epandrium *atra* (p. 211)
- Capitellum yellow or whitish; male: surstylus without such outwardly inclined tubercle; cercus articulated with epandrium 22
- 22 Postfrons with small median glossy zone, much narrower than lateral subshining (non-pruinescent) zone (Fig. 121); cheek more than one third as high as eye; male: segment 8 slender throughout; epandrium very broad; cerci clavate, narrow and widely separated basally (Fig. 123) *petiolus* (p. 200)
- Postfrons with larger median glossy zone, c. as wide as or wider than lateral subshining zone (Figs 125, 130); cheek usually one third as high as eye or less; male: abdominal segment 8 widened anteriorly or moderately broad throughout; epandrium less than twice as broad as segment 8; cerci variable but not widely separated and clavate 23
- 23 Postfrons very extensively shining, with little pruinescence even on anterior half; male: epandrium on each side with two large anteroventral bristles, each at least one third as long as epandrium; surstylus distally on inner surface armed with complex, fascicle-like spines; cercus rod-like, long and slender (Fig. 154); habitat southwestern Australia *woodhilli* (p. 212)
- Postfrons pruinescent on much of anterior half; male: epandrium without such large bristles; surstylus with simple spines and/or setulae only; cercus relatively broad, not rod-like; habitat eastern Australia (including Tasmania) 24
- 24 Postfrons with pair of sublateral shining zones resembling median glossy zone, but not fused with it; subapical spur of hind tibia nearly as long as greatest diameter of tibia; male: surstylus only slightly widened basally, almost straight; cercus plate-like, with very long fringe of mollisetae (Fig. 129); female: tergite 5 with median grey-pruinescent zone on full length *fimbria* (p. 203)
- Postfrons either without markedly shining sublateral zones extending in front of level of anterior ocellus, or median and sublateral zones fused to form broad shining zone; subapical spur of hind tibia generally much shorter than greatest diameter of tibia or indistinguishable; male: surstylus very broad basally, curved; cercus with short setulae only; female (unknown in *B. acumen*): tergite 5 pruinescent anteriorly, but without such complete median pruinescent zone 25
- 25 Male: protandrium scarcely narrowed posteriorly; epandrium (Fig. 142) broadly attached to protandrium, dorsobasally prominent and, when in anteriorly flexed position, projecting posteriorly beyond end of protandrium; cercus small, transverse; female: tergite 6 undivided; cercus slightly bulbous apically *merzi* (p. 206)
- Male: protandrium narrowed posteriorly; epandrium shortly attenuated at base and not strongly projecting; cercus large, transversely compressed; female (unknown in *B. acumen*): tergite 6 divided by median desclerotization; cercus not thickened apically 26
- 26 Postfrons with subtriangular, median glossy zone, but without markedly shining non-pruinescent lateral zones extending in front of level of anterior ocellus; male: surstylus (Fig. 133) with large, broadly rounded anterior basal dilation, its slender apex directed anteriorly; cercus ovate, obtuse *bulberti* (p. 205)
- Postfrons with lateral glossy zones fused with median zone to form broad glossy zone extending in front of anterior ocellus; male: surstylus (Fig. 146) broadly spatulate, without such rounded anterior basal expansion; cercus broad, shortly narrowed to subacute apex *acumen* (p. 209)

- 27 Postfrons in front of level of anterior ocellus entirely dull, with fingerprint sculpture and / or pruinescence; sternopleuron almost entirely densely pruinescent (*staniochi* group) 28
- Postfrons with extensive smooth, glossy zone in front of anterior ocellus; sternopleuron shining and bare, at least in part (*helenae* group) 29
- 28 Mesopleuron very extensively pruinescent, glossy only on small zone near anterior margin (Fig. 66); cheek yellow in large part (at least in male); mid tibia in both sexes with well-developed subapical posterior spur and ventral spur; distal section of vein 6 extending three quarters of distance from anal crossvein to posterior wing margin; male: cercus (Fig. 67) small and narrow *dayi* (p. 178)
- Mesopleuron glossy centrally and anteriorly (Fig. 74); cheek entirely black to dark brown; mid tibia in both sexes with at most very small subapical posterior spur, with subapical ventral spur in female only; distal section of vein 6 extending no more than two thirds distance to margin; male: cercus (Figs 77, 79) broad *staniochi* (p. 180)
- 29 Mesopleuron largely glossy black, with small pruinescent zone on dorsal margin only (Fig. 81); fore femur with at least three long posteroventral bristles, but no anteroventral comb; fore tarsus entirely brown; capitellum of halter yellowish brown to dark brown *helenae* (p. 183)
- Mesopleuron extensively pruinescent, on both dorsal and posterior margins; fore femur with posteroventral bristles little developed, but, in male only, with comb of stout, moderately short anteroventral bristles; fore tarsus bicoloured, segment 1 dark brown, segments 2 to 5 pale yellowish; capitellum of halter creamy-white *doreenae* (p. 186)

Stewarti group

Diagnostic description. Anterior fronto-orbital bristle variable in size and inclination; antennal segment 3 markedly longer than deep, generally porrect; mesoscutum with numerous setulae, at least on central part; dorsocentral bristles three, all behind level of transverse suture; mesopleuron without setulae; mid tibia with two or three anterior bristles basad of level of preapical dorsal pair, also large anterior and posterior subapical spurs, with ventral subapical spur well developed in female only; length of discal cell along vein 5 more than 3× distance of its posterodistal angle from margin, latter measured in direction of distal section of vein 5; section of vein 5 on discal cell straight; distal section of vein 6 long, distally gradually fading and usually curved distad; anal crossvein well sclerotized; abdominal sternite 1 divided by median desclerotization.

Included species. *Borboroides stewarti*, *B. musica*, *B. danielsi*, *B. lindsayae*, *B. tonnoiri*, *B. donaldi*.

Borboroides stewarti n.sp.

Figs 20, 21, 26–35

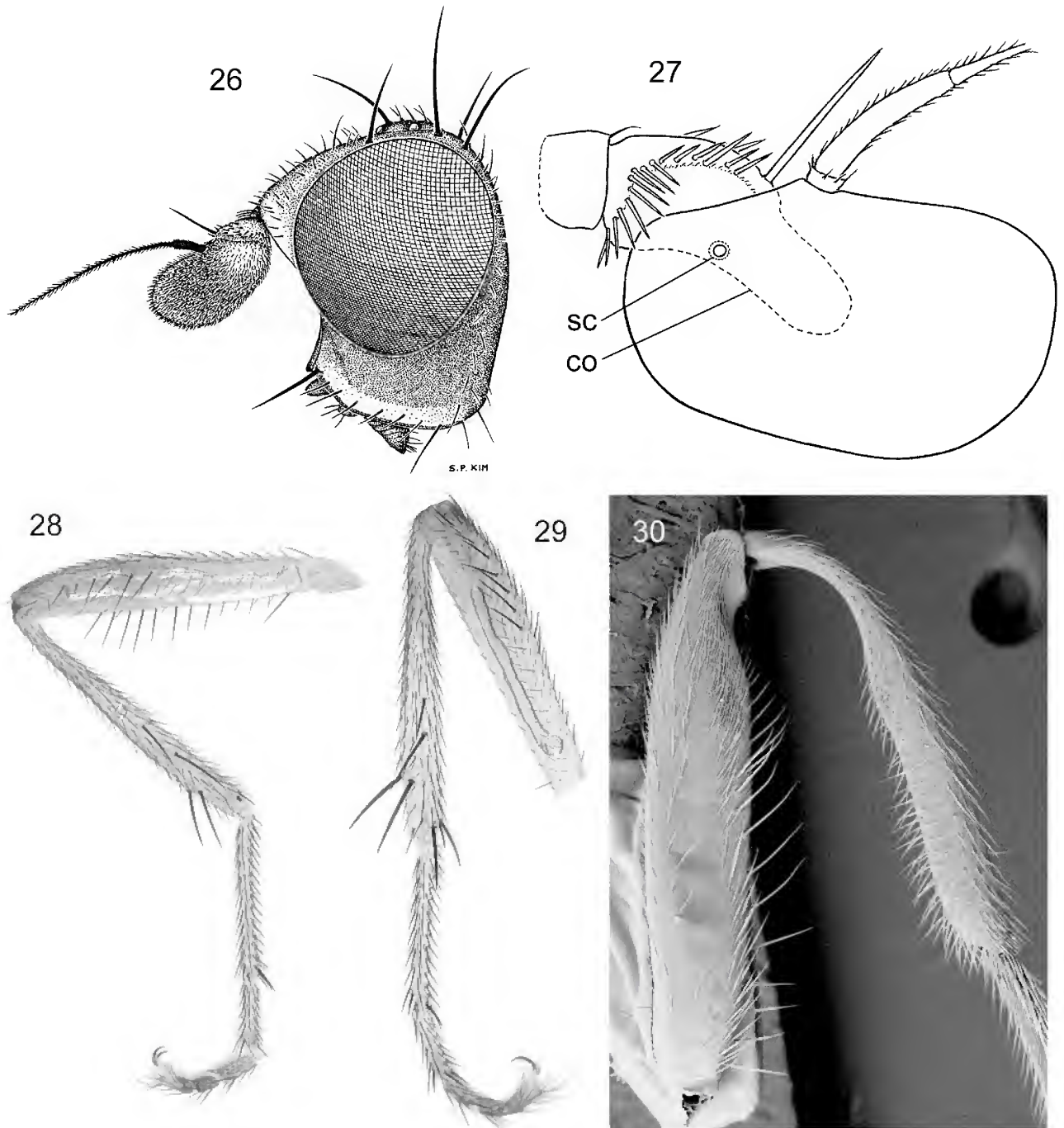
Material examined. HOLOTYPE ♂, New South Wales: Mount Wilson [Blue Mountains; Waterfall Reserve, c. 900 m, 33°31'S 150°23'E], 6–7.v.2002, D.K.M. (AM K219743). Mounted on card point. PARATYPES. New South Wales: 47♂♂, 51♀♀, Mount Wilson, March, April, May, June, Oct. 1957–2002, B.J.D., K.C.K., D.K.M. (AM, BM, CNC, USNM); 3♂♂, 2♀♀, 26–27 mi. [c. 42–43 km] from Glen Innes, Glen Innes to Grafton Highway [Gibraltar Range

vicinity], April 1970, D.H.C. (ANIC); 2♂♂, Mount Kaputar National Park [Narrabri district], May 1984, K.C.K. (AM); 1♂, Wright's Lookout, New England National Park, March 1961, D.K.M. (AM); 1♀, Barrington House, 92 km NE of Singleton [Williams River near Salisbury], June 1976, Z.R.L. (ANIC); 4♂♂, Kanangra Road, 14.2 km S of Oberon–Jenolan Road junction, April 2002, B.J.D., D.K.M. (AM); 1♂, 2♀♀, 2 mi. [c. 3 km] SW of Tumorrana [Tumut district], June 1964, G.L.B. (AM); 1♀, Monga [Braidwood district], July 1962, D.H.C. (ANIC); 4♂♂, 3♀♀, 5 mi. [c. 8 km] S of Monga, May 1968, D.H.C., Z.R.L. (ANIC); 1♂, 1♀, Mongarlowe River, Clyde Mountain, May 1965, D.H.C. (ANIC); 1♂, Cabbage Tree Creek, Clyde Mountain, May 1965, R.L. (ANIC); 3♀♀, Araluen, Aug. 1982, Z.R.L. (ANIC). Australian Capital Territory: 3♂♂, 3♀♀, Mount Coree, April 1968, D.H.C. (ANIC); 1♂, 2♀♀, Blundells Creek, April, Oct. 1987, D.H.C. (ANIC); 3♂♂, Bull's Head, March, April 1968–1969, D.H.C., Z.R.L. (ANIC); 1♂, Honeysuckle Creek, April 1985, I.D.N., J.C.C. (ANIC).

Other material (localities only given). Victoria: Toorloo Arm, Lakes Entrance (ANIC); Fernshaw, near Healesville (AM); Mount Donna Buang, near summit (AM, MV).

Description (male, female). Moderately elongate, largely tawny fly with darker markings on thorax and legs; size large for the genus.

Coloration. Head tawny-yellow; postfrons largely dull, pruinescent, with small shining or subshining zones on each side of posterior ocelli and immediately in front of anterior ocellus; posterior part of postfrons suffused with brown; ocellar spot brown to black; occipital region suffused with brown to blackish on much of upper half. Antennal segment



Figs 26–30. (26) *Borboroides stewarti*, head of male. (27) Right antenna of same (male). (28) Right mid leg of same, anterior view (male), anterior subapical tibial spur broken, base visible. (29) Right mid leg of same, anterior view (female). (30) Part of right hind leg of same, posterior view (male). *co*, conus; *sc*, sacculus.

3 suffused with grey-brown distally. Prelabrum and palpus yellow, sometimes darker in female. Thorax yellowish tawny; mesoscutum with generally complete median brown stripe extending on to scutellum, and variable lateral brown zone; pleura, including hypopleuron, almost entirely pruinose except for small shining anteroventral zone on mesopleuron; upper part of pleura with variable brown zone, usually extending from near prothoracic spiracle to pleurotergite. Legs tawny, often with variable degree of brown suffusion on femora and tibiae; hind femur dark brown distally to variable extent. Wing yellowish hyaline, unmarked. Halter yellow, capitellum often paler. Abdomen brown to tawny-brown,

often darker in female.

Head much higher than long; eye slightly higher than long; postfrons with setulae on anterior half mostly inclined forwards and mesad, more numerous towards ptilinal suture; junction of postfrons and face forming acute angle in profile in male, not angular in female; height of cheek 0.29–0.47 of height of eye (ratio higher in females); ocellar bristle longer than posterior fronto-orbital bristle; postvertical bristle slightly shorter than posterior fronto-orbital; anterior fronto-orbital bristle reclinate, less than half as long as posterior fronto-orbital, sometimes vestigial. Antenna approximately porrect; segment 2 small, with very oblique distal articular

surface; segment 3 c. 1.6× as long as deep, larger in male than in female; arista slightly longer than greatest diameter of eye; segment 6 with many short hairs no longer than greatest diameter of segment 5. Prelabrum moderately large in female, narrower and shallower in male; palpus moderately short and narrow.

Thorax somewhat slender; mesoscutum c. as wide as long or almost so; intradorsocentral setulae in c. two pairs of irregular rows; mesopleuron without setulae; the following thoracic bristles well developed: humeral, 1 + 1 notopleurals, presutural, supra-alar, postalar, posterior intra-alar, three dorsocentrals, of which first distinctly behind suture, about as long as second and distinctly shorter than third one, one sternopleural; prescutellar acrostichal bristle absent. Fore leg without stridulatory modification; fore femur with several long anterodorsal and usually slightly smaller anteroventral bristles; mid femur with a series of anterior bristles from just beyond mid-length, also, in male only, with a series of strong posteroventral bristles; hind femur with one large anterodorsal bristle near distal quarter and, in male only, with subapical posteroventral excavation preceded by a series of numerous posteroventral bristles; mid tibia straight, slightly more slender in male, with usually two anterior bristles, one anterior and one posterior subapical spur, with large subapical ventral spur in female, none in male, without mollisetae or particularly enlarged hairs in either sex; hind tibia without subapical anteroventral spur, that of male only attenuated and strongly curved on c. basal quarter. Wing: humeral break of costa and corresponding break of subcosta indistinct; subcosta entirely sclerotized and pigmented to junction with costa; vein 2 distally almost parallel with vein 3 though slightly curved; apical section of vein 4 1.8–2.3× as long as penultimate section; section of vein 5 on discal cell almost straight or almost imperceptibly arched; discal cell very elongate (compared with that of *B. atra* and related species); basal crossvein oblique, but meeting penultimate section of vein 5 at marked angle; posterodistal angle of anal cell obtuse; distal section of vein 6 long, apically curved distad and fading out before reaching margin.

Abdomen. Sternite 1 reduced, represented by pair of separate lateral plates; in male, tergites 4 and 5 with particularly long lateral marginal bristles and sternite 4 with more numerous long bristles on each side, sternite 5 divided into two widely separated strongly setulose plates; in female, these sclerites without particularly long bristles, sternite 5 undivided, tergite 5 with anterior margin c. as broad as and fitted to posterior margin of tergite 4, not retractile beneath tergite 4. Male postabdomen: tergite 6 only indistinctly sclerotized; spiracle 6 in membrane but well removed posteroventrally from tergite 6, nearer to spiracle 7; protandrial synsternite elongate-ovoid, somewhat asymmetrical in general shape; sternite 6 with thickened anterior rim on left side, enclosing spiracle 7, which has strongly raised rim to form short projecting cylinder; semi-sclerotized broad tubercle present on right side of anterior part of ventral protandrium membrane; posterior part of ventral surface of protandrium (in front of sclerotized ventral bridge) with asymmetrical pair of sclerites—that on left side forming isolated plate with numerous strong, minutely serrated ridges and no spinules nor microtrichia, that on right side connected to synsternite, without ridges, with group of c. nine erect blunt spinules and few microtrichia, some of which are similarly blunt; epandrium very broad,

but asymmetrically attenuated at base, with many setulae, some dorsal ones longest; anteroventral bridge of epandrium well developed; surstylus large, with complex array of lobes, and combs and fascicles of setulae and spinules as in Fig. 32; gonite very broad, basally narrowed, its distal margin anteriorly with single series of stout blunt to subacute spinules, posteriorly with dense, non-seriate longer, fine-tipped spinules, its inner surface with additional lobe bearing numerous spinules distally; aedeagus with sclerotized slightly clavate, slightly scabrous basiphallus, and with pair of slender lateral horn-like processes; distiphallus bulky, tapered near terminal gonopore, arising from anterior surface of basiphallus, with many small scale-like processes except near apex; cerci connected only at bases, slightly narrowed and truncate apically (in posterior view), each with an outer marginal series of stout setulae only; proctiger bituberculate, with thick dorsally directed pubescent process. Female postabdomen not abruptly narrowed; tergites 4, 5, 6, 7 gradually sequentially decreasing in size; cercus rather short and stout, with moderately short setulae.

Dimensions. Total length, ♂ 2.3–3.3 mm, ♀ 2.5–3.4 mm; length of thorax, ♂ 1.1–1.5 mm, ♀ 1.2–1.6 mm; length of wing, ♂ 3.5–4.4 mm, ♀ 3.4–4.5 mm.

Distribution. New South Wales: cooler areas from Glen Innes district southwards. Australian Capital Territory: ranges W of Canberra. Victoria: areas E of Melbourne.

Notes

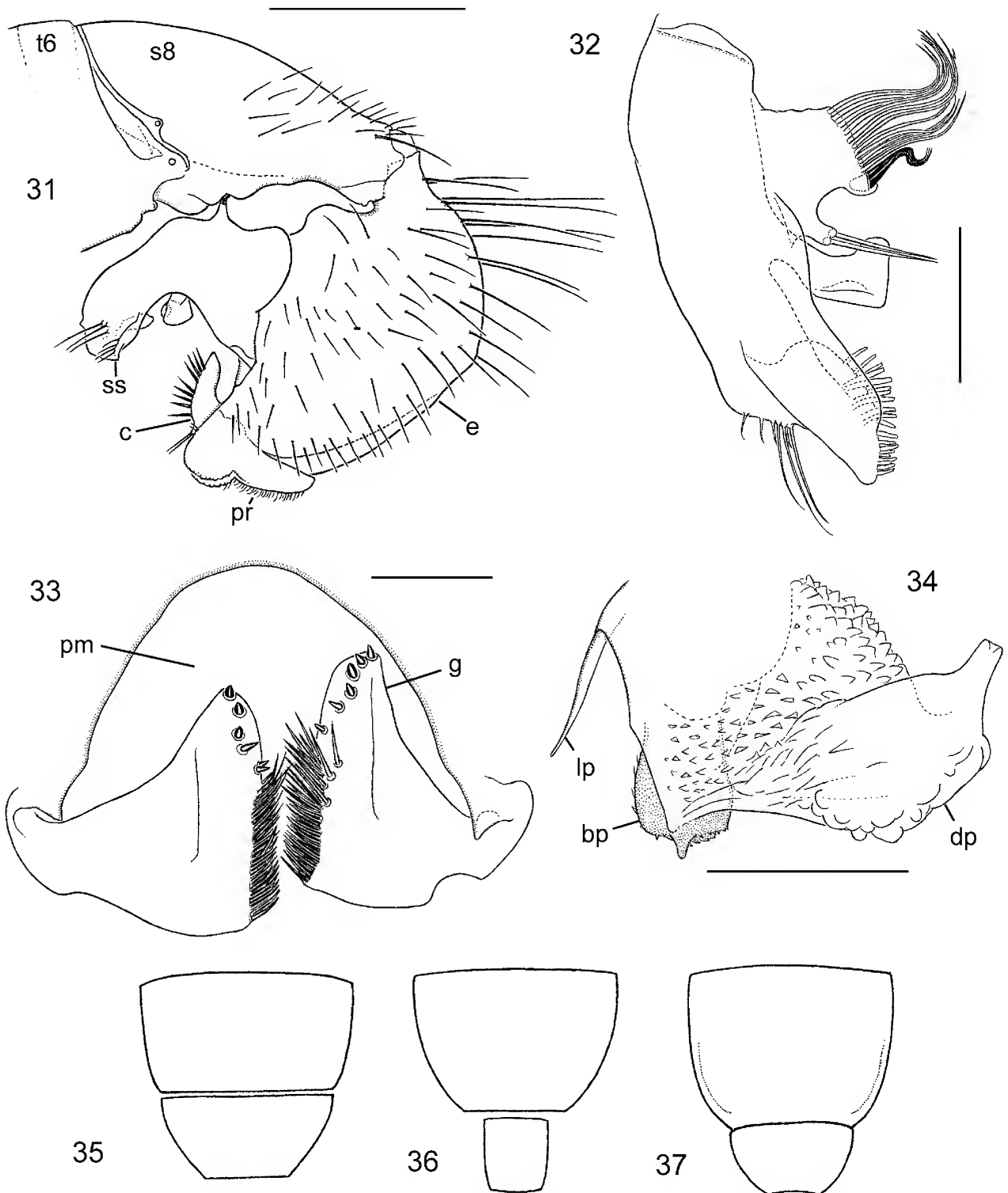
Borboroides stewarti has the characters of the *stewarti* group as given above. Within the group it agrees particularly with *B. musica* in having the thorax yellowish tawny with few brown markings. It is distinguished from *B. musica* by having the anterior fronto-orbital bristle very small and not proclinate and, under high magnification, by the absence of the stridulatory organ on the fore coxa and femur; also in the female by the much less reduced abdominal tergite 5, and in the male by the strongly curved basal part of the hind tibia and the comb-like series of strong posteroventral bristles on the mid femur.

Adults are attracted to wombat dung, and are most frequently collected in the autumn.

Borboroides musica n.sp.

Figs 15–17, 22–25, 36, 38–41, 166

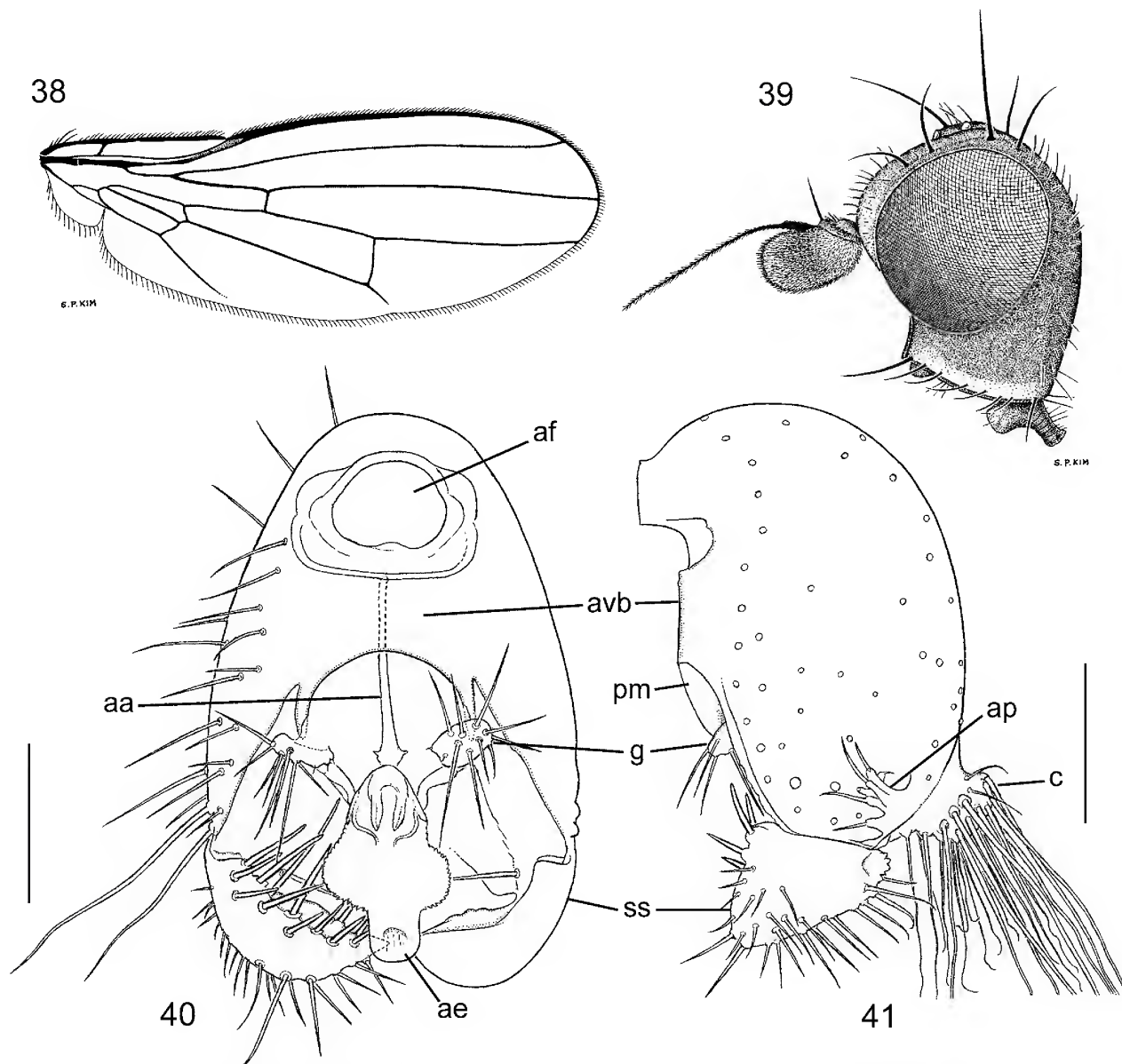
Material examined. HOLOTYPE. ♂, New South Wales: Mount Wilson [Blue Mountains; Waterfall Reserve, c. 900 m, 33°31'S 150°23'E], 24–25.iii.2002, D.K.M. (AM K219744). Mounted on micropin through polyporus. PARATYPES. New South Wales: 48 ♂♂, 24 ♀♀, Mount Wilson, March, April, May, June, Oct. 1957–2005, D.K.M. (AM, ANIC); 111 ♂♂, 51 ♀♀, Kanangra Road, 9.2 and 14.2 km S of Oberon–Jenolan Road junction, April 2002–2004, B.J.D., D.K.M. (AM, BM, CNC, MV, NAT, TAU, USNM); 2 ♂♂, 1 ♀, Boyd River crossing, Kanangra-Boyd National Park, April 2002–2004, B.J.D., D.K.M. (AM); 2 ♂♂, Rudy's Road turnoff, 15 km N of Jenolan, April 2004, B.J.D. (AM); 1 ♀, Black Springs fossicking area, Vulcan State Forest, 27 km SSW of Oberon, May 2003, B.J.D. (AM).



Figs 31–37. (31) *Borboroides stewarti*, male postabdomen, left lateral view; scale = 0.5 mm. (32) Right surstylus of same, anterior view; scale = 0.2 mm. (33) Hyandrial structures of same, anteroventral view; scale = 0.1 mm. (34) Aedeagus of same, anterior aspect, part of base concealed; scale = 0.1 mm. (35–37) tergites 4 and 5 of female abdomen (diagrammatic, setulae omitted) of *B. stewarti* (35), *B. musica* (36), and *B. donaldi* (37). *bp*, basiphallus; *c*, cercus; *dp*, distiphallus; *e*, epandrium; *g*, gonite; *lp*, lateral process of aedeagus (paired); *pm*, prehypandrial membrane; *pr*, proctiger; *ss*, surstylus; *s8*, sternite 8; *t6*, tergite 6.

Other material (localities only given). New South Wales: Putty Road, 41 km N of Colo River bridge [Yengo National Park] (AM); 2 mi. [c. 3 km] SW of Tumorrana [Tumut district] (AM); Monga [Braidwood district] (ANIC); 4 and 5 mi. S of Monga (ANIC); Mongarlowe River, Clyde

Mountain (ANIC); Kunama, Batlow district (ANIC); Rutherford Creek, Brown Mountain (ANIC). Australian Capital Territory: Mount Coree (ANIC); Bull's Head (ANIC); Tidbinbilla (AM); Honeysuckle Creek (ANIC); Blundells Creek (ANIC). Victoria: 10 km S of Bonang (ANIC); road



Figs 38–41. (38) *Borboroides musica*, wing. (39) Head of male of same. (40) Epandrial and hypandrial structures of same, anteroventral view, cerci omitted, macrotrichia omitted from left side of epandrium and left surstylus; scale = 0.2 mm. (41) Epandrium and associated parts of same, left lateral view. *aa*, aedeagal apodeme; *ae*, aedeagus; *af*, anterior (intersegmental) foramen of epandrium; *ap*, anterior prominence of cercus (visible through epandrium); *avb*, anteroventral bridge of epandrium; *c*, cercus; *g*, gonite; *pm*, prehypandrial membrane; *ss*, surstylus.

to Mount Magnet, Wilson's Promontory (AM); 13 mi [c. 21 km] W of Matlock (AM); Warburton (AM); near summit of Mount Donna Buang, near Warburton (AM, MV); Fernshaw, near Healesville (AM, MV); Mayer's Creek, near Healesville (ANIC); Kinglake (ANIC).

Description (male, female). Strongly resembling *B. stewarti* in many respects; agreeing with description given for that species, except as indicated below.

Coloration generally resembling that of *B. stewarti*. Occipital region of head often with less dark suffusion than in *B. stewarti*.

Head. Height of cheek 0.41–0.54 of height of eye; anterior fronto-orbital bristle only slightly smaller than posterior one, proclinate and often slightly inclined outwards. Antennal segment 3 c. 1.3–1.4× as long as deep, generally very slightly more elongate in male than in female.

Thorax rather slender for *stewarti* group; intradorsocentral setulae few, in one pair of rows; dorsocentral bristles three, mid one scarcely shorter than anterior one, sometimes a quite small additional shorter bristle at level of transverse suture. Fore leg with unique stridulatory modification (visible only at higher magnification, see description above); mid femur usually more noticeably curved in male than in female, with anterior bristles but no posteroventral bristles in either sex; hind femur with a simple series of ventral, rather than posteroventral bristles in male only, and no posteroventral excavation; mid tibia essentially as described for *B. stewarti*; hind tibia with quite small but distinct subapical ventral spur, in male without strong curvature or other modification except that ventral setulae on distal part are numerous and conspicuously erect (less conspicuous and more nearly decumbent in female). Wing elongate, slightly narrowed basally across anal region; subcosta weakly sclerotized and

slightly pigmented distally; apical section of vein 4 1.6–1.9× as long as penultimate section; distal section of vein 6 long, but generally less curved distally than in *B. stewarti*.

Abdomen. In male, tergite 5 broad, but much shorter than tergite 4, with relatively few bristles/setulae; sternite 5 sclerotized on whole width, but setulose mainly at sides; in female, tergite 5 less than half as wide as tergite 4, almost parallel sided, with few long posterior setulae. Male postabdomen: tergite 6 vestigial; spiracle 6 present in membrane on each side; sternite 6 developed on left side only; spiracle 7 present on each side, left one enclosed within posterior lobe of sternite 6; segment 8 rather stout, only slightly narrowed posteriorly, with few large anterolateral setulae and smaller posterodorsal setulae; epandrium subovoid, approximately symmetrical, with ventral transverse ridge on anterior part of anteroventral bridge; surstylus somewhat rounded in outline, slightly broader than long, of much simpler form than that of *B. stewarti*, with thickened incurved distal margin, with numerous moderate-sized setulae on outer surface and mainly long, thick, spinescent, inwardly directed setulae on anterodistal margin, and with densely spinose posterodistal prominence; gonite small, depressedly subovate (in Fig. 40 each of pair seen from different angle as result of pressure from cover slip), with relatively few strong setulae; basiphallus short, with pair of somewhat approximated short, sharp-edged anterior lamellae, but no long lateral processes (as are present in *B. stewarti*); distiphallus bulbous, with somewhat narrowed apical part bearing gonopore on anterior subapical surface, surface of bulbous part strongly scabrous, with very dense small tubercles varying from rounded to subconical; aedeagal apodeme long and slender; cerci well separated at bases, each short, rounded, not compressed, with brush of very dense mollisetae on convex distal surface, some c. as long as epandrium, and with anterior fascicle of finger-like setiferous processes, largely concealed in lateral view; proctiger not prominent, located in groove. Female postabdomen slender; cercus more slender than in *B. stewarti*.

Dimensions. Total length, ♂ 2.4–3.0 mm, ♀ 2.0–3.6 mm; length of thorax, ♂ 0.95–1.3 mm, ♀ 1.1–1.5 mm; length of wing, ♂ 3.2–4.0 mm, ♀ 3.4–4.6 mm.

Distribution. New South Wales: mainly cooler districts, from Colo River district southwards. Australian Capital Territory: Canberra district. Eastern Victoria.

Notes

Borboroides musica agrees with *B. stewarti* in its relatively pale colouring, the thorax being largely tawny with some darker brown markings. Other species of the *stewarti* group have the thorax predominantly deep brown to black, except in very faded specimens. *Borboroides musica* differs from *B. stewarti* in the well-developed proclinate anterior fronto-orbital bristle (much smaller and reclinate in *B. stewarti*), in the male by the absence of posteroventral bristles on the mid femur, the almost straight hind tibia, and the very differently shaped and armed surstylus and cercus, in the female by the narrow, parallel-sided abdominal tergite 5. The stridulatory organ on the foreleg (Figs 22–25) is peculiar to this species, but can only readily be discerned with CLM or SEM.

Most of our recently collected specimens of *B. musica* were obtained on or near wombat dung.

The specific epithet is a Latin adjective, musical, in reference to the stridulatory organ.

Borboroides danielsi n.sp.

Figs 42–46

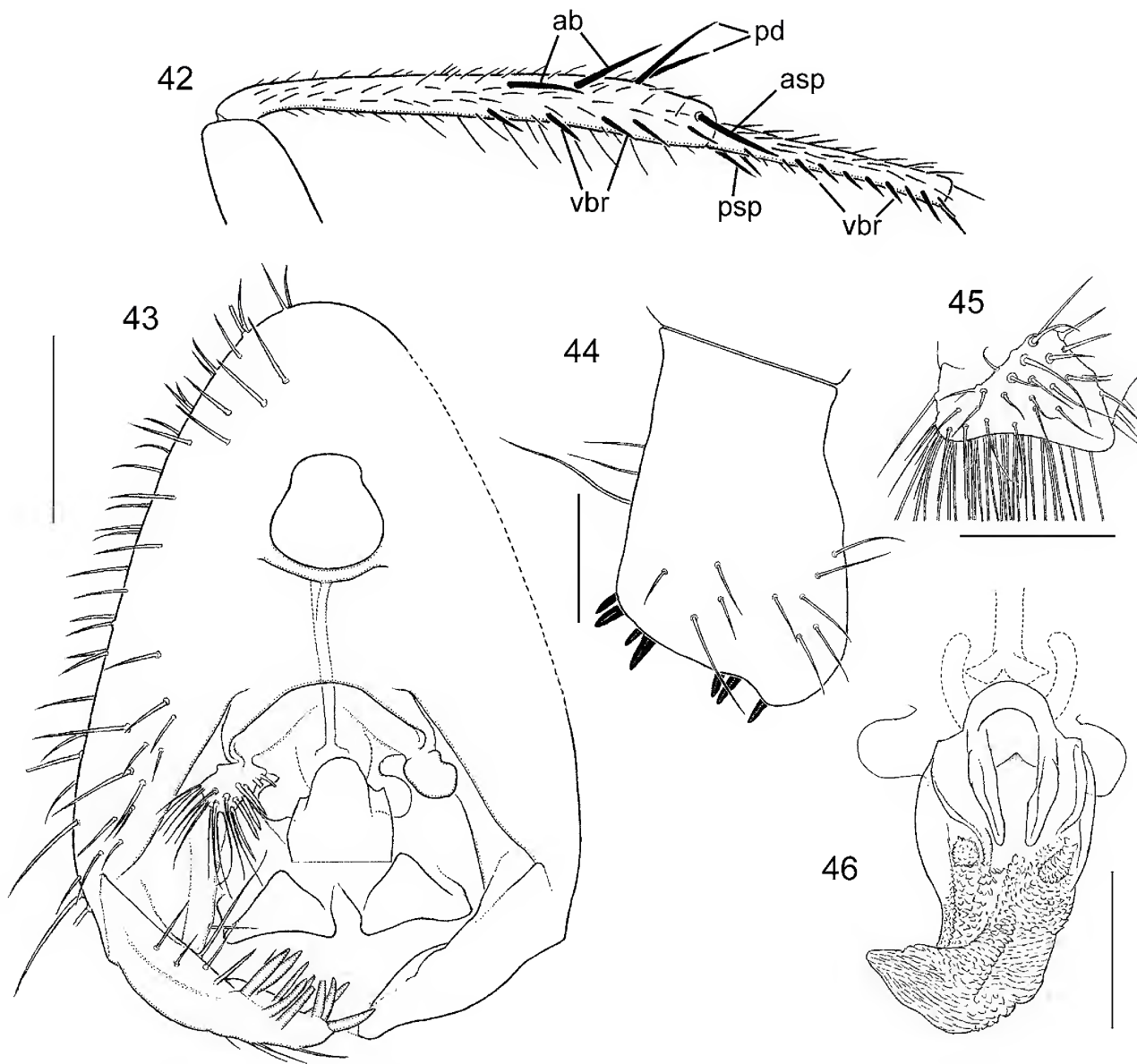
Material examined. HOLOTYPE. ♀, New South Wales: Boyd River [or Morong Creek] crossing, Kanangra-Boyd National Park, 13.iv.2004, D.K.M. (AM K219745). Near wombat dung. Mounted on card point. PARATYPES. New South Wales: 3 ♀ ♀, same locality as holotype, April 2002–2004, B.J.D., D.K.M. (AM); 2 ♂ ♂, 11 ♀ ♀, Kanangra Road, 9.2 km S of Oberon-Jenolan Road junction, April 2004, B.J.D. (AM); 1 ♂, 1 ♀, Baldy Bill Fire Road, Kanangra Plateau, March 1975, G.D. (UQ); 2 ♂ ♂, 1 ♀, Rudy's Road turnoff, 15 km N of Jenolan Caves, April 2004, B.J.D. (AM); 2 ♂ ♂, 15 ♀ ♀, Barrington Tops, April 1949, S.J.P. (ANIC).

Description (male, female). Moderately small blackish fly, slightly stouter than other species of *stewarti* group.

Coloration. Head with c. posterior half of postfrons and entire occiput black to brown-black; c. anterior third to half of postfrons and cheek tawny yellow, latter coloration giving way to dark brown where it impinges on lower occiput; face predominantly brown or tawny-brown, with greyish pruinescence; postfrons almost entirely densely pruinescent, with very small shining zone in front of anterior ocellus and shining to subshining zone laterad of each posterior ocellus. Antenna tawny; segment 3 extensively suffused with dark brown. Prelabrum and palpus black or brown-black. Thorax black, with dark grey pruinescence covering most of surface; small anteroventral zone of mesopleuron glossy black; barete (or katepimeron sensu J. McAlpine, 1981: 26, 27) with small yellow spot (sometimes indistinct). Coxae and femora largely dark brown to blackish, latter often with narrowly yellowish apices; tibiae tawny-brown to yellowish; tarsi yellow, becoming brown distally. Wing membrane faintly smoky, without markings; veins yellowish brown. Halter yellow, with pale brownish base. Abdominal tergites and sternites 1 to 5 in male, 1 to 7 in female black or dark brown with extensive grey pruinescence; tergite 5 of female with pair of widely separated glossy black lateral zones; in male sternite 8 and epandrium black with grey pruinescence, latter often partly tawny brown; in female cercus yellow or tawny-yellow.

Head higher than long; eye rounded, slightly higher than long; postfrons only moderately prominent anteriorly; anterior half of postfrons with numerous short, non-seriate, mostly proclinate setulae; height of cheek 0.36–0.48 of height of eye; posterior fronto-orbital bristle of only moderate length, markedly shorter than ocellar bristle; anterior fronto-orbital bristle eclinate–reclinate, not more than half as long as posterior one, sometimes much less. Antenna resembling that of *B. tonnoiri*, but segment 3 shorter in both sexes, with similar sexual dimorphism. Prelabrum broader and deeper in female than in male; palpus of moderate length.

Thorax rather stout (for *stewarti* group); intradorsocentral setulae in two pairs of well developed but rather irregular series; mesopleuron without setulae; thoracic bristles as given for *B. tonnoiri*. Fore leg without stridulatory modification; fore femur with a well-developed series each of posterodorsal and posteroventral bristles; mid femur not much curved,



Figs 42–46. (42) *Borboroides danielsi*, part of left mid leg, approximate anterior view (male). (43) Epandrial and hypandrial structures of same, anteroventral view, aedeagus curtailed to show other parts, macrotrichia omitted from all left side parts and from both cerci; scale = 0.2 mm. (44) Left surstylus of same, outer surface view; scale = 0.1 mm. (45) Right cercus of same, anterior view; scale = 0.1 mm. (46) Aedeagus of same, anterior view; scale = 0.1 mm. *ab*, anterior bristles; *asp*, anterior subapical spur; *pd*, preapical dorsal bristles; *psp*, posterior subapical spur; *vbr*, ventral bristles.

slightly more slender than other femora, with anterior bristles of small to moderate size, and, in male only, with a ventral to posteroventral longitudinal series of fine erect setulae; hind femur without apparent sexual dimorphism, with preapical dorsal bristle; fore tibia sometimes with distinct preapical dorsal bristle; mid tibia with usual pair of preapical dorsal bristles, one or two anterior bristles, a longitudinal series of two to four short ventral bristles, one anterior and one posterior subapical spur, also one ventral subapical spur well developed only in female, in male with few erect hair-like posteroventral setulae; hind tibia almost straight, with distinct preapical dorsal bristle and vestigial subapical anteroventral spur; mid basitarsus with a series of small, spaced ventral bristles or stout setulae, more distinct and regular than in most species. Wing similar to that of *B. musica* (Fig. 38); apical section of vein 4 1.8–2.5× as long as penultimate section.

Abdomen. Sternite 1 reduced, represented by pair of lateral plates; in male, tergite 5 much shorter than tergite 4 but nearly as wide; sternite 5 much shorter than sternite 4, not attenuated medially; in female, tergite 5 and sternite 5 respectively slightly shorter than tergite 4 and sternite 4. Male postabdomen: tergite 6 vestigial; sternite 6 forming strongly sclerotized and pigmented band on left side, dorsally fused with sternite 8; segment 8 moderately elongate, subconical, with sternite 8 ventrally bridged on anterior part; epandrium subovoid, extensively setulose with non-terminal anterior foramen and extensive anteroventral bridge with thickened transverse ridge on margin of foramen; surstylus subquadrate, slightly longer than broad, with few setulae of various sizes and, on inner surface of distal part, numerous large spinules; prehypandrial membrane receding but not invaginated, with many comb-like groups of short microtrichia; gonite short and tumid, with moderately

long setulae on outer surface and spinescent setulae on medial surface; aedeagus with pair of rounded, membranous laterobasal wings; basiphallus very short, apparently sclerotized at sides; distiphallus moderately short and stout, tapered distally, with pair of anterobasal lamellae, and beyond base with many tooth-like and scale-like tubercles and some fine ridging; aedeagal apodeme long, with ventral branch connecting to marginal ridge of epandrial foramen; cercus short and moderately broad, subtruncate distally, its posterior surface with elongate setulae, the longer ones tending towards mollisetae, its anterior prominence also with well-developed setulae. Female postabdomen tapering but not much attenuated; tergites and sternites 6 and 7 undivided, not elongate; tergite 8 divided by median desclerotization; cercus moderately elongate, not clavate.

Dimensions. Total length, ♂ 2.4–2.9 mm, ♀ 2.6–3.2 mm; length of thorax, ♂ 1.1–1.5 mm, ♀ 1.2–1.5 mm; length of wing, ♂ 2.3–3.3 mm, ♀ 3.1–3.7 mm.

Distribution. New South Wales: highlands, from Barrington Tops to Jenolan Caves district.

Notes

Borboroides danielsi is a species of the *stewarti* group with almost entirely black thorax. Among the three other such species it is distinguished from *B. donaldi* by the extensively pruinulent mesopleuron without a central glossy zone, by the presence of two or more short, stout non-terminal ventral bristles on the mid tibia, and by having the middle dorso-central bristle as long as the anterior one, also by numerous details of the male postabdomen, and the pruinulent tergite 4 and less reduced tergite 5 of the female. From *B. lindsayae* and *B. tonnoiri* it is distinguished by the darkly pigmented prelabrum and lower occipital region of the head; also in the male by the absence of long ventral mollisetae on the mid tibia, the non-invaginated prehypandrial membrane, and the stout spines on the surstylus; in the female by the extensively pruinulent tergite 5 (particularly its central part).

The material collected by B.J.D. and the author was taken around wombat dung baits.

The specific epithet refers to Gregory (Greg) Daniels, who collected this and other interesting species of *Borboroides*.

Borboroides lindsayae n.sp.

Figs 47–50

Material examined. HOLOTYPE. ♂, Australian Capital Territory: Mount Gingera [Brindabella Range], 14.iv.1968, D.H.C. (ANIC). Mounted on micropin through polyporus. PARATYPES. Australian Capital Territory: 3 ♀, same data as holotype (ANIC); 2 ♂, Bull's Head, near Canberra, April 1968, D.H.C. (AM, ANIC). Victoria: 8 ♂, 1 ♀, Mount Donna Buang, near summit [Warburton district], April 2003, B.J.D., D.K.M. (AM, MV).

Description (male, female). Large fly for the genus, resembling *B. tonnoiri* in most characters except as indicated below.

Coloration. Head tawny-yellow; vertex of postfrons and upper part of occiput suffused with brown, sometimes faintly

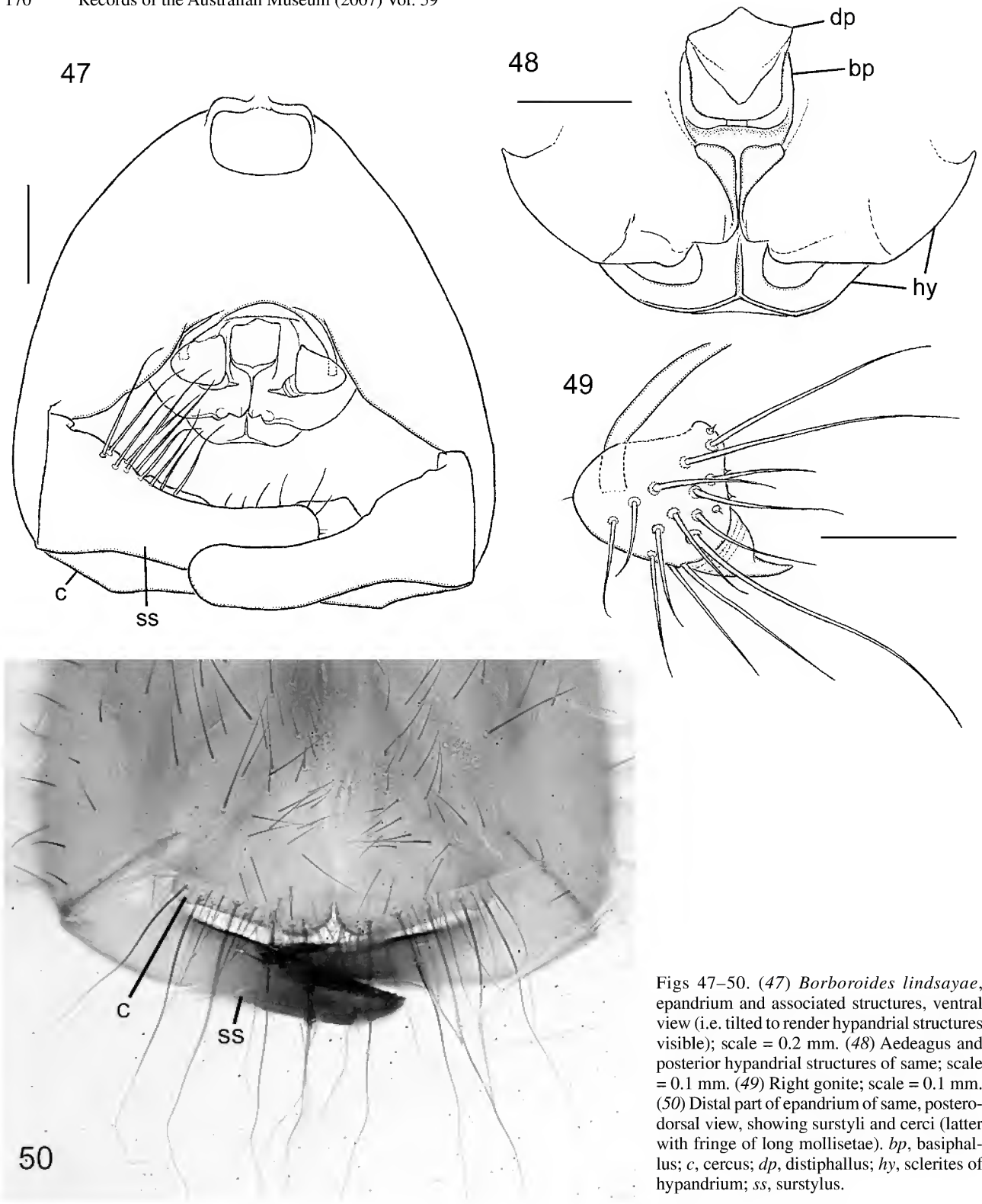
so in males, more intensely browned in females; postfrons entirely pruinulent, without distinctly shining zones. Thorax with dorsal surface predominantly blackish with thick covering of brown pruinulence; region of humeral callus, notopleuron, and sometimes lateral parts of scutellum tawny in males, these parts usually darker in females; pleura tawny with some brown suffusion in males, largely brown in females. Legs tawny, femora often brown to blackish distally, more consistently so in females; tarsi browned distally. Abdomen largely blackish, with grey to brown pruinulence on tergites; epandrium largely tawny.

Head. Postfrons slightly less narrowly projecting anteriorly than in *B. tonnoiri*; height of cheek 0.51–0.62 of height of eye; anterior fronto-orbital bristle usually distinctly more than half as long as posterior one, inclined outwards and slightly forwards. Antenna: segment 3 markedly less elongate than in *B. tonnoiri* and in male less nearly parallel-sided.

Thorax. Intradorsocentral setulae in two pairs of rows, the outer row usually nearly as developed as paramedian row, latter row usually extended posteriorly well beyond level of posterior dorsocentral bristle. Legs with armature and male modifications as in *B. tonnoiri*, except hind femur with two longitudinally aligned anterodorsal bristles (in addition to slightly developed subapical one). Wing: apical section of vein 4 1.4–2.1× as long as penultimate section.

Abdomen. Preabdomen generally resembling that of *B. tonnoiri*; in female, sternite 5 nearly twice as long as sternite 4; in male, sternite 5 almost crescentic, but attenuated medially, setulose only on lateral parts. Male postabdomen: protandrial complex asymmetrical anteriorly, somewhat as in *B. tonnoiri*; sternite 8 moderately elongate, with numerous setulae laterally and near posterodorsal margin; epandrium inflated, large for overall size of insect, with numerous moderate-sized setulae, generally distributed except in region of deep, extensive anteroventral bridge; surstylus more elongate than *B. tonnoiri*, parallel-sided beyond the slightly broadened base, with fine anterior setulae including long ones near base and small distal ones, without stouter setulae or spines, distal margin rounded, but with several shallow, inwardly directed serrations; prehypandrial membrane relatively restricted in area, deeply cupped so as to be scarcely visible in normal anteroventral view (somewhat as in *B. tonnoiri* and *B. donaldi*), with dense groups of mostly very short microtrichia on visible surface; hypandrium consisting of pair of broad lateral plates and broad posteromedian plate, all of complex structure (some details not visible in Fig. 45); gonite short, rounded, bearing both long and minute fine-tipped setulae, the former not as long and numerous as in *B. tonnoiri*, on medial side process attached to hypandrium by subconical support which bears medially directed sclerotized spine; aedeagus approximately symmetrical, without paired processes; basiphallus short, sclerotized; distiphallus rather short and stout, but not distally inflated, with much of surface scabrous with dense, minute, mostly subconical tubercles; aedeagal apodeme apparently short and little sclerotized; cerci very broad, meeting on median line, each broadly truncate, with moderate setulae anteriorly and few very long submarginal posterior setulae or mollisetae, not forming a conspicuous brush and much less dense than in *B. tonnoiri* (Fig. 50).

Dimensions. Total length, ♂ 2.9–3.7 mm, ♀ 2.9–3.5 mm; length of thorax, ♂ 1.4–1.6 mm, ♀ 1.4–1.6 mm; length of wing, ♂ 4.2–4.7 mm, ♀ 4.3–5.1 mm.



Figs 47–50. (47) *Borboroides lindsayae*, epandrium and associated structures, ventral view (i.e. tilted to render hypandrial structures visible); scale = 0.2 mm. (48) Aedeagus and posterior hypandrial structures of same; scale = 0.1 mm. (49) Right gonite; scale = 0.1 mm. (50) Distal part of epandrium of same, postero-dorsal view, showing surstyli and cerci (latter with fringe of long mollisetae). *bp*, basiphallus; *c*, cercus; *dp*, distiphallus; *hy*, sclerites of hypandrium; *ss*, surstylus.

Distribution. Australian Capital Territory: Brindabella Range. Victoria: Yarra Valley district. The species has been rarely collected, but possibly occurs more widely on or near mountain tops of southeastern Australia.

Notes

Among the relatively large-sized species included in the *stewarti* group, *Borboroides lindsayae*, together with *B. tonnoiri*, is recognized by having the ground colour of the

mesoscutum black to dark brown (except towards lateral margins), overlaid by grey or brown pruinescence, the mesopleuron very largely dull-pruinescent, and the mid tibia without short seriate ventral bristles in either sex. Males of these species differ from other species of the group in the many conspicuously long ventral mollisetae on the mid tibia, and from species other than *B. donaldi* in the deeply recessed hypandrial complex. In *B. lindsayae* the anterior fronto-orbital bristle is inclined outwards and forwards, and is generally more than half as long as the posterior one; in *B.*

tonnoiri the anterior fronto-orbital is inclined outwards and backwards and is not more than half as long as the posterior one. In fresh specimens of *B. lindsayae* the thoracic dorsum is dark brown, rather than grey-black as in *B. tonnoiri*. In males of *B. lindsayae* the surstylus is more elongate than in *B. tonnoiri* and the cercus is much less densely setulose-mollisetose. The female of *B. lindsayae* has a large shining, almost smooth zone on abdominal sternite 5; in *B. tonnoiri* this sternite is entirely densely pruinulent.

A single male specimen (Mount Donna Buang, Victoria, April 1963, AM) is possibly an aberrant diminutive individual of *B. lindsayae* or even a hybrid. The cercus and surstylus appear to agree with this species, so far as they can be interpreted without special preparation, but the anterior fronto-orbital bristle is reclinate, the mid tibia has no mollisetae but has a large subapical ventral spur, and the hind femur has only one anteroventral bristle.

Borboroides lindsayae has not been taken by us at wombat dung. The specimens collected at Mount Donna Buang by B.J.D. and D.K.M. were on wallaby dung, probably from *Macropus rufogriseus* (Desmarest).

The specific epithet refers to Suzanne M. Lindsay who carried out the electron microscopy for this and other projects.

Borboroides tonnoiri n.sp.

Figs 51–57

Material examined. HOLOTYPE. ♂, New South Wales: Black Springs fossicking area, Vulcan State Forest, c. 27 km SSW of Oberon, 4.v.2003, B.J.D. (AM K219746). Mounted on micropin through polyporus. PARATYPES. New South Wales: 9♂♂, same data as holotype (AM); 27♂♂, 11♀♀, Mount Wilson [Blue Mountains], April, May, June 1957–2004, D.K.M., B.J.D. (AM, MV, BM); 1♀, Mount York, Blue Mountains, July 1986, D.K.M., B.J.M. (AM); 1♀, Mount Boyce, Blue Mountains, May 1967, D.K.M. (AM); 1♀, Hampton, Aug. 1932, F.H.T. (AM); 13♂♂, Rudy's Road turnoff, 15 km N of Jenolan, April 2004, B.J.D. (AM, USNM); 4♂♂, Kanangra Road, 9.2 and 14.2 km S of Oberon-Jenolan Caves road junction, April, Aug. 2002–2004, B.J.D. (AM); 2♂♂, 2 mi. [c. 3 km] SW of Tumorrana, June 1964, G.L.B. (AM); 1♂, Whiskers, 7 km WNW of Hoskinstown, Queanbeyan district, May 1991, M.S.U. (ANIC); 6♂♂, Clyde Mountain, west slope, May 1965, D.H.C., Z.R.L. (ANIC); 28♂♂, 3♀♀, Mongarlowe River, Clyde Mountain, May 1965, D.H.C. (ANIC); 1♀, Kunama, Batlow district, Aug. 1961, D.H.C. (ANIC); 2♂♂, 2♀♀, Alpine Creek, Kiandra, March, Aug. 1961–1962, D.H.C. (ANIC). Australian Capital Territory: 52♂♂, 40♀♀, Mount Coree, Brindabella Range, April 1968, D.H.C. (ANIC); 7♂♂, 12♀♀, Bull's Head, Brindabella Range, April 1968–1972, D.H.C., D.K.M. (AM, ANIC, UQ); 1♂, Black Mountain, Canberra, May 1968, I.F.C. (ANIC); 1♂, 1♀, Honeysuckle Creek, May 1985, I.D.N., J.C.C. (ANIC); 7♂♂, 4♀♀, Blundell's, April 1930, 1931, A.L.T., L.F.G. (ANIC); 1♂, Snowy Flats, Brindabella Range, March 1977, G.D. (UQ).

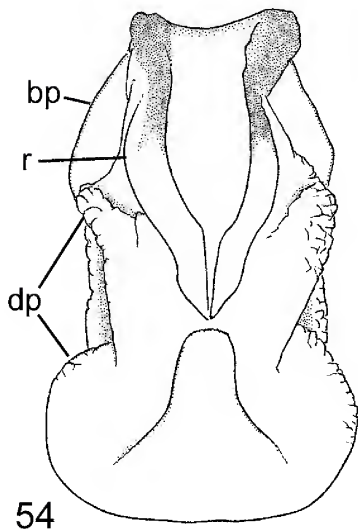
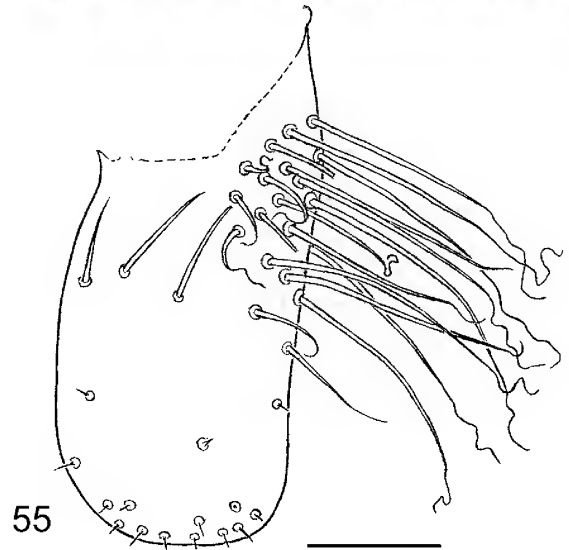
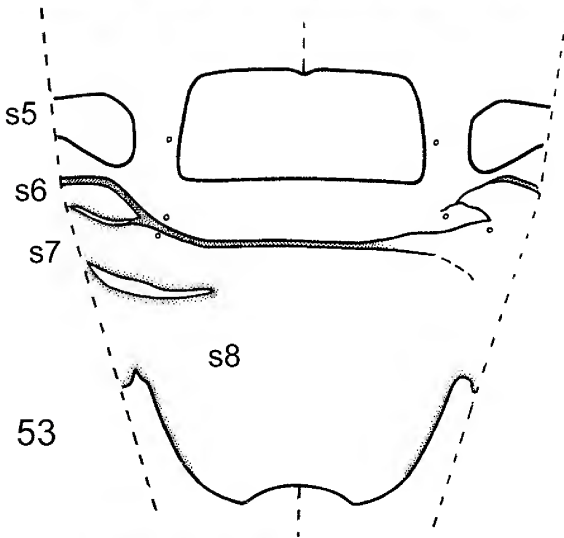
Other material. Victoria: 1♀, Mount Donna Buang, near summit, Warburton district, April 2003, B.J.D., D.K.M. (AM).

Description (male, female). Moderately elongate largely blackish fly; size large for the genus.

Coloration. Head tawny-yellow; posterior part of postfrons and only c. upper half of occipital region blackish; postfrons extensively pruinulent, distinctly shining only on zone laterad of each posterior ocellus. Antenna tawny-yellow; segment 3 extensively suffused with grey-brown; arista dark brown. Prelabrum yellow to tawny-yellow; palpus tawny-yellow (most males) to dark brown (most females). Thorax predominantly black to dark brown, with extensive greyish pruinulence; pleura with variable tawny-yellow markings; mesopleuron with small bare, shining anteroventral zone not reaching to fore-coxal foramen. Legs tawny-yellow; femora variably, often extensively brown to blackish distally; tibiae, particularly fore tibia, sometimes suffused with brown; tarsi browned distally. Wing hyaline, with tawny-brown veins. Halter yellow to creamy. Abdomen largely black; in male, epandrium usually partly yellow; in female, tergite 5 largely glossy, broadly grey-pruinulent on anterior margin, narrowly so on posterior margin; sternite 5 entirely dull, pruinulent; tergites 6 and 7 greyish-pruinulent.

Head slightly higher than long; eye c. as high as long; postfrons anteriorly projecting and forming acute angle with face in profile, more distinctly so in male than in female; setulae on anterior half of postfrons numerous but small, proclinate except for those on orbital margin; height of cheek 0.47–0.67 of height of eye; ocellar bristle slightly longer than posterior fronto-orbital; anterior fronto-orbital bristle c. half as long as posterior one or less, inclined outwards and slightly reclinate. Antenna porrect; segment 2 with very oblique articular surface; segment 3 longer and more nearly parallel-sided in male than in female; arista slightly longer than greatest diameter of eye; segment 6 with many hairs, mostly shorter than greatest diameter of segment 5. Prelabrum rather large and prominent in female, less so in male; palpus of moderate size.

Thorax somewhat elongate; mesoscutum c. as wide as long or slightly less; intradorsocentral setulae mostly in a pair of paramedian rows, of which no or very few setulae are placed as far back as posterior dorsocentral; very few setulae placed between paramedian row and dorsocentral line; mesopleuron without setulae; the following thoracic bristles all well developed: humeral, 1+1 notopleurals, presutural, supra-alar, postalar, posterior intra-alar, three dorsocentrals, of which first close behind transverse suture, about as long as second, one sternopleural; prescutellar acrostichal bristle absent. Fore leg without stridulatory modification; fore femur with a posterodorsal and a posteroventral series of long bristles; mid femur almost straight in female, longer, slender and distinctly curved in male, with a series of stout anterior bristles and, in male only, a series of numerous long, fine posteroventral setulae; hind femur stouter than mid-femur, particularly so in male, with one anterodorsal bristle at c. distal quarter of length, and, in male only, few scattered, non-seriate ventral bristles and long setulae; mid tibia with two or three long anterior bristles basad of level of preapical dorsal pair and one anterior and one posterior subapical spur, also, in female only, one ventral bristle near mid-length and one large ventral subapical spur, in male with very numerous long ventral mollisetae on almost whole length of tibia, many of them half as long as tibia or longer,



Figs 51–55. (51) *Borboroides tonnoiri*, part of epandrium and associated structures, ventral view, surstyli removed to show densely mollisetae cerci. (52) Left mid leg of male of same, anterior view. (53) Protandrogram of same (diagram of male abdominal segments 5–8). (54) Aedeagus of same, anterior view; scale = 0.1 mm. (55) Left surstylus of same, medial view; scale = 0.1 mm. *bp*, basiphallus; *dp*, distiphallus; *r*, anteroventral ridge of aedeagus; *s5–s8*, sternites 5–8.

only slightly less developed in diminutive specimens; hind tibia nearly straight, with slight curvature at extreme base, with preapical dorsal bristle large in female, smaller in male, with subapical anteroventral spur poorly differentiated or absent; mid basitarsus with some ventral mollisetae in male; hind basitarsus relatively short. Wing resembling that of *B. stewarti*; vein 2 more distinctly curved and divergent from vein 3 near apex; apical section of vein 4 1.2–1.9× as long as penultimate section.

Abdomen. Sternite 1 reduced, represented by pair of separate lateral plates; tergites 2 to 5 with some enlarged lateral and posterior setulae; in male, tergite 5 shorter than tergite 4; sternite 4 with moderate sized setulae only; sternite 5 much shorter than wide, transversely narrowed but not divided medially; in female tergite 5 slightly longer than tergite 4 and almost as wide; sternite 5 only slightly longer than sternite 4. Male postabdomen: tergite 6 vestigial, scarcely sclerotized; sternite 6 strongly sclerotized on left side, merged with sternites 7 and 8 in compound protandrial sclerite, which is moderately elongate, posteriorly narrowed, and has broad ventral bridge; spiracles 6 both in intersegmental membrane; both spiracles 7 within anterior part of protandrial sclerite; epandrium ovoid-triangular, with numerous moderately long setulae and very extensive anteroventral bridge occupying nearly half length of epandrium; surstylus rather broad, almost parallel-sided, with few setulae of various sizes and group of large mollisetae on anterior side of basal half, without spinules; prehypandrial membrane restricted to anterior wall of lining of narrow cup-like cavity containing basiphallus, its surface with numerous short, comb-like groups of short microtrichia; gonite more elongate than in *B. lindsayae*, subcylindrical, with many large mollisetae on distal part and few minute setulae on medial surface; aedeagus approximately symmetrical; basiphallus short, sclerotized posteriorly; distiphallus stout, very broad subapically, but with narrowed, usually anteriorly reflexed apex, with extensively scabrous or scaly surface, and pair of anterobasal sclerotized ridges; cercus very broad and rather short, neither much compressed nor with anterobasal prominence, with setulae and many densely placed large mollisetae forming a conspicuous widely fluffed brush.

Dimensions. Total length, ♂ 2.0–3.3 mm, ♀ 2.2–3.5 mm; length of thorax, ♂ 0.99–1.5 mm, ♀ 0.99–1.5 mm; length of wing, ♂ 3.2–4.4 mm, ♀ 3.1–4.4 mm.

Distribution. New South Wales: cooler districts from Blue Mountains southwards. Australian Capital Territory: Brindabella Range and vicinity. Victoria: Yarra Valley district—single record.

Notes

Borboroides tonnoiri belongs among those species of the *stewarti* group with largely black thoracic dorsum (when unfaded) and the mesopleuron almost entirely pruinose, which species include also *B. danielsi* and *B. lindsayae*. From *B. danielsi* it is distinguished by the largely yellowish lower region of the occiput, in the male by the great development of ventral mollisetae on the mid tibia (Fig. 52) and the presence of mollisetae instead of thick spinules on the surstylus, and in the female by the presence of only one ventral bristle on the mid tibia (in addition to the subapical ventral spur) instead of a longitudinal series of such bristles. *Borboroides*

tonnoiri is distinguished from *B. lindsayae* by the shorter anterior fronto-orbital bristle and by other characters given under that species.

Borboroides tonnoiri has often been collected around wombat dung baits.

The specific epithet refers to André Léon Tonnoir, dipterist, who collected this species in 1930 and 1931 not far from where, on a later visit (1940), he died alone in the bush.

Borboroides donaldi n.sp.

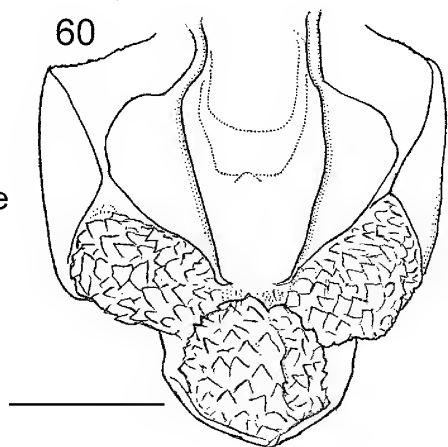
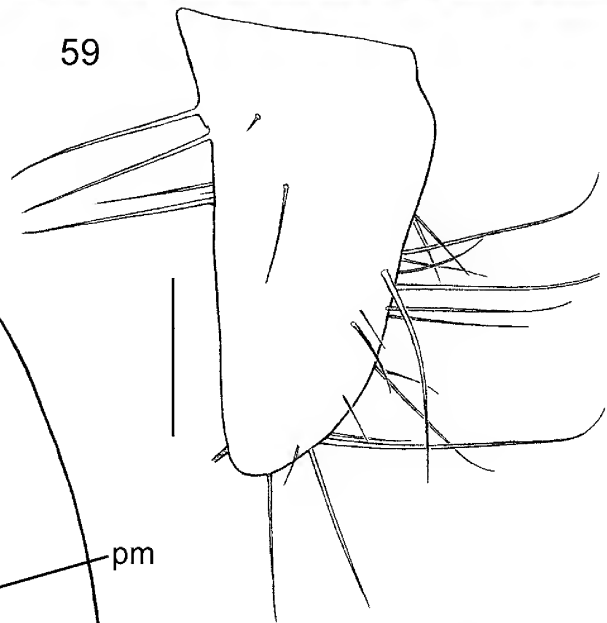
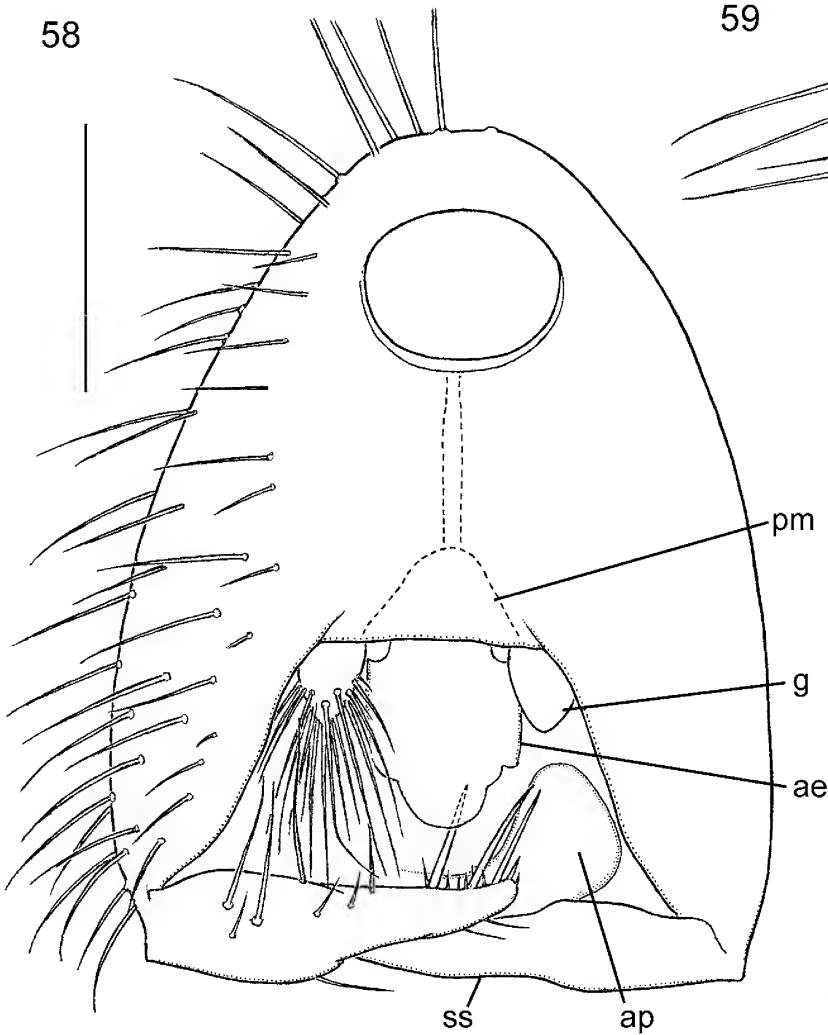
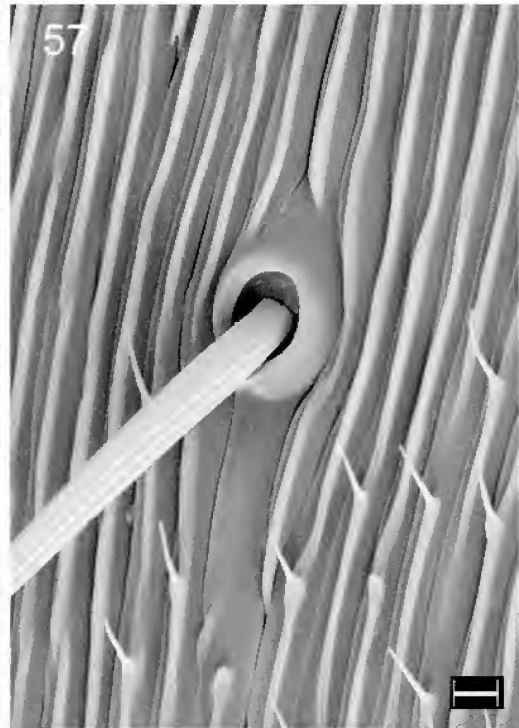
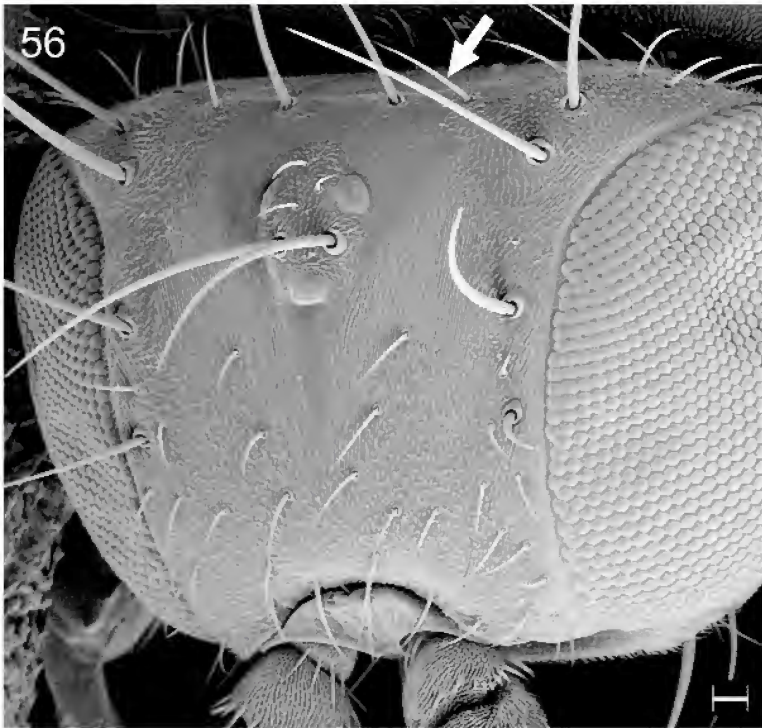
Figs 37, 56–60

Material examined. HOLOTYPE. ♂, New South Wales: Mount Wilson [Blue Mountains; Waterfall Reserve, c. 900 m, 33°31'S 150°23'E], 6–7.v.2002, D.K.M. (AM K219747). Mounted on card point. PARATYPES. New South Wales: 1 ♂, same data as holotype (AM); 8 ♂♂, 1 ♀, Kanangra Road, 14.2 km S of Oberon–Jenolan road junction, April 2002, B.J.D. (AM, ANIC, USNM); 1 ♂, Boyd River crossing, Kanangra-Boyd National Park, April 2004, D.K.M. (AM); 4 ♂♂, Black Springs fossicking area, Vulcan State Forest, c. 27 km SSW of Oberon, May 2003, B.J.D. (AM); 1 ♀, 2 mi. [c. 3 km] SW of Tumorrana [Tumut district], June 1964, G.L.B. (AM); 3 ♀♀, Kunama [Batlow district], Aug. 1961, D.H.C. (AM, ANIC); 1 ♂, Clyde Mountain, west slope, May 1965, Z.R.L. (ANIC); 6 ♂♂ Mongarlowe River, Clyde Mountain, May 1965, D.H.C. (ANIC); 5 ♂♂, 1 ♀, 5 mi. [c. 8 km] S of Monga [Braidwood District], May 1968, D.H.C., Z.R.L. (ANIC). Australian Capital Territory: 15 ♂♂, 3 ♀♀, Bull's Head, April, Oct. 1960–1972, D.H.C., D.K.M. (AM, ANIC); 29 ♂♂, 1 ♀, Mount Coree, April 1968, D.H.C. (AM, ANIC); 1 ♀, Tidbinbilla, Aug. 1972, D.K.M. (AM); 1 ♂, Honeysuckle Creek, Aug. 1985, I.D.N., J.C.C. (ANIC).

Other material. (localities only given). Victoria: Frenchman's Gap, near Woods Point, 3,500 ft [c. 1,070 m] (AM); 13 mi. [c. 21 km] W of Matlock (AM, MV); Mount Donna Buang, near Warburton (AM).

Description (male, female). Rather small, partly dark-coloured, partly shining fly, somewhat resembling *B. musica* and *B. stewarti*, agreeing with description given for latter, except as indicated.

Coloration. Prelabrum yellow, often darker tawny brown, in female; palpus brown. thorax largely black to blackish brown (unfaded specimens); mesoscutum with lateral zone, including part of humeral callus and notopleuron, tawny brown, often with indication of tawny-brown dorsocentral mark or line (more obvious in faded specimens); pleura with tawny stripe on propleuron, lower part of mesopleuron, upper margin of sternopleuron, and often smaller zone on hypopleuron; pleura generally pruinose, except for large bare, glossy zone covering central and anteroventral parts of mesopleuron, but not reaching fore-coxal foramen. Legs of male yellowish to tawny, with all femora and tarsi distally browned to variable extent; legs of female usually more extensively browned. Abdomen largely black to dark brown; male with tawny areas on tergites 4 and 5, parts of sternite 8 and posterior part of epandrium; female with entire preabdomen black (unfaded specimens); tergite 4 bare and glossy; tergite 5 densely grey- to brown-pruinose, with small shining black zone on each lateral extremity.



Head. Eye subcircular, usually not higher than long; height of cheek 0.44–0.57 of height of eye; anterior fronto-orbital bristle sloped outwards and usually very slightly reclinate, c. half as long as posterior fronto-orbital or slightly more. Antenna: segment 3 of male not as large as in *B. stewarti*, distinctly more elongate than in female.

Thorax. Mesoscutum c. as wide as long in female, slightly narrower in male; intradorsocentral setulae in one paramedian pair of rows, not reaching posteriorly to level of posterior dorsocentral bristle, at most few setulae between these and dorsocentral lines; middle dorsocentral bristle at least slightly shorter than anterior one, sometimes much reduced. Legs: mid femur without posteroventral bristles in either sex; hind femur of male with single series of fine, inconspicuous posteroventral bristles and no posteroventral excavation; mid tibia with mid-ventral subapical spur large in female, small or scarcely differentiated in male; hind tibia of male almost straight, not particularly attenuated basally. Wing: subcosta weakly sclerotized distally, its junction with costa not easily visible; veins 2 and 3 slightly diverging distally; apical section of vein 4 1.8–2.3× as long as penultimate section.

Abdomen. In male tergites and sternites 4 and 5 with moderately developed setulae only; sternite 5 medially attenuated rather than divided; in female tergite 5 much shorter than tergite 4, capable of withdrawal and concealment below tergite 4. Male postabdomen: protandrium resembling that of *B. musica* but more slender; epandrium broadly inflated, approximately symmetrical, with no transverse ridge on anteroventral bridge, except that which borders on anterior foramen; surstylus of simple form, much longer than broad, compressed, not incurved, with few setulae, some quite long, and two or three much thicker long setulae on inner surface towards apex; prehyandrial membrane invaginated behind the unusually extensive anteroventral bridge, thus not readily externally visible; gonite anteriorly prominent, with numerous long setulae having attenuated tips; basiphallus broad, with pair of almost membranous anterior lamellae and incurved lateral wings; distiphallus on anterior surface with scale-like roughening, many of the

processes acute; distal part of distiphallus rounded, flexed forwards; cerci short, moderately broad, approximated on median line, withdrawn and largely concealed in most views by epandrium and surstyli, each with some setulae on distal margin less developed than *B. musica*, and bulbous densely setulose sea-urchin-like anterior extension, setulae of latter with simple bases (unlike corresponding anterior setulae of *B. musica*). Female postabdomen somewhat resembling that of *B. stewarti*.

Dimensions. Total length, ♂ 1.7–2.5 mm, ♀ 2.6–3.2 mm; length of thorax, ♂ 0.75–1.1 mm, ♀ 1.2–1.4 mm; length of wing, ♂ 2.3–3.3 mm, ♀ 3.5–4.2 mm.

Distribution. New South Wales: cooler districts, from Blue Mountains southwards. Australian Capital Territory: Canberra district. Eastern Victoria.

Notes

Borboroides donaldi belongs in the *stewarti* group, with which it agrees in venation and setulosity of the mesoscutum. It is distinguishable from *B. stewarti* and *B. musica* by the much darker thorax. Males are distinguishable from the dark-coloured *B. lindsayae* and *B. tonnoiri* by the absence of a ventral brush of long mollisetae on the mid tibia, and females differ from these two species in the large, strongly shining tergite 4 with lateral submarginal groove and relatively small tergite 5. *Borboroides donaldi* differs from all other species of the *stewarti* group in having a very large central glossy zone on the mesopleuron. As usual the male postabdominal characters are distinctive, but the invagination of the prehyandrial membrane, so that it is concealed in anteroventral view, occurs also in *B. lindsayae* and *B. tonnoiri*.

Borboroides donaldi has been collected around wombat dung bait on several occasions.

The specific epithet refers to Donald H. Colless, whose extensive collections of *Borboroides* (in ANIC) form a major basis for this study.

Figs 56–60 [facing page]. (56) *Borboroides donaldi*, dorsal view of head of male; scale = 30 µm, paravertical bristle indicated. (57) Detail of part of postfrons of same, showing fingerprint sculpture, with microtrichia and one setula; scale = 3 µm. (58) Epandrium and associated structures of same, anteroventral view, macrotrichia omitted from left side; scale = 0.2 mm. (59) Left surstylus of same, outer surface view; scale = 0.1 mm. (60) Aedeagus of same, anterior view; scale = 0.05 mm. *ae*, aedeagus; *ap*, anterior prominence of cercus; *g*, gonite; *pm*, prehyandrial membrane (invaginated); *ss*, surstylus.

Perkinsi group

Diagnostic description. Only posterior fronto-orbital bristle well developed, anterior one vestigial; antennal segment 3 markedly longer than deep, porrect; mesoscutum without setulae; three long dorsocentral bristles present, anterior one in front of transverse suture; mesopleuron with several setulae; mid tibia in both sexes with one anterior bristle slightly basad of level of preapical dorsal pair, and subapical spurs as follows: vestigial anterior one, one long and one short ventral one (no posterior one); length of discal cell along vein 5 more than 3× distance of its posterodistal angle from margin, latter distance measured in direction of distal section of vein 5; section of vein 5 on discal cell straight or almost so for most of length; distal section of vein 6 sclerotized, more than twice as long as well sclerotized posterior crossvein, abruptly discontinued distally and not curved distad; abdominal sternite 1 divided by median desclerotization.

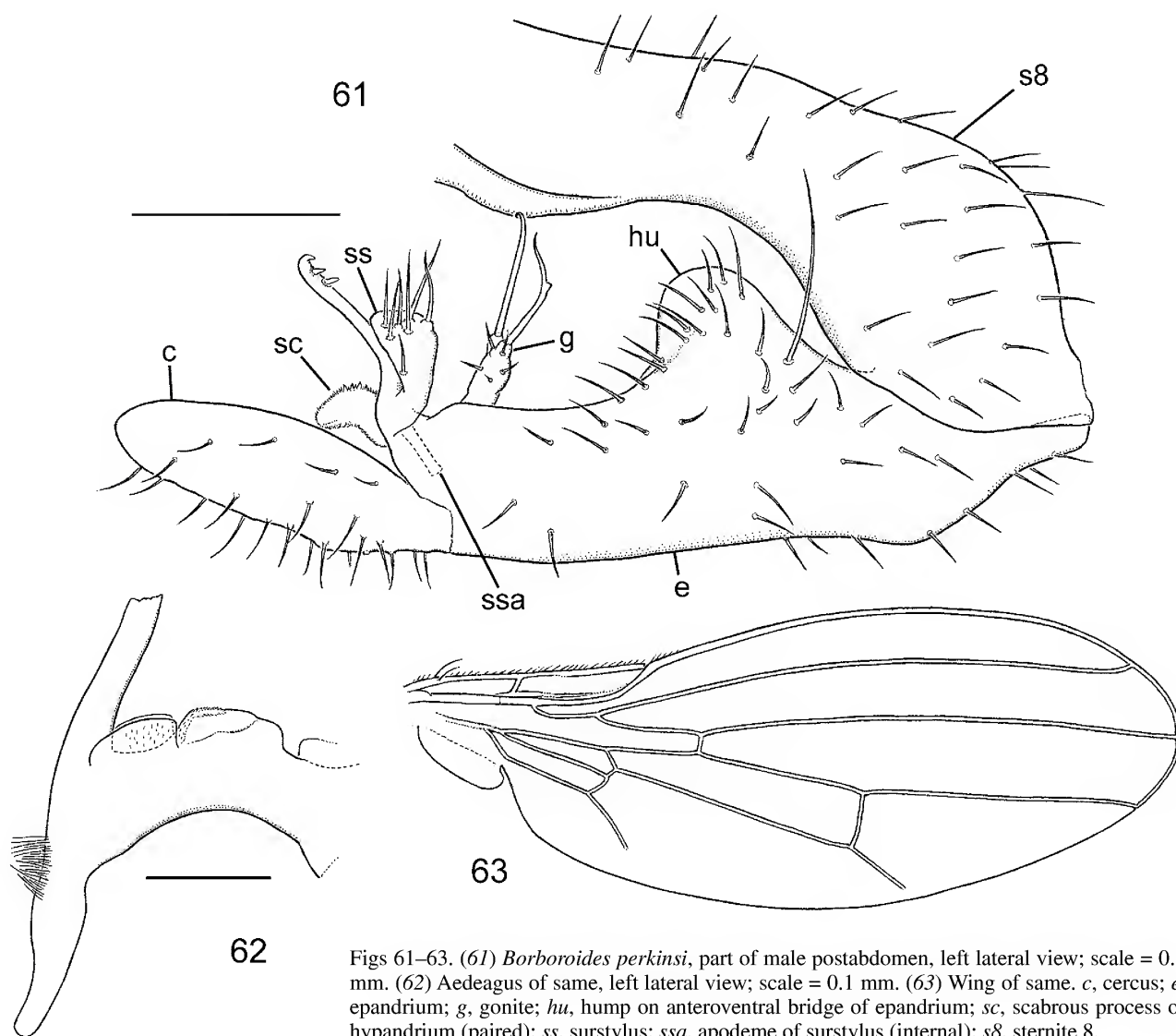
Included species. *Borboroides perkinsi* n.sp.

Borboroides perkinsi n.sp.

Figs 18, 19, 61–63

Material examined. HOLOTYPE. ♂, New South Wales: 5 miles [“5 m.”, i.e. c. 8 km] S of Monga, Braidwood district, 8.v.1968, D.H.C., Z.R.L. (ANIC). On micropin through polyporus. PARATYPES. New South Wales: 9♂♂, 11♀♀, 3, 4, and 5 mi. [c. 5, 6, and 8 km] S of Monga, May 1968, D.H.C., Z.R.L. (AM, ANIC); 1♂, 2♀♀, Mount Wilson, Blue Mountains, May, June 2002–2004, D.K.M. (AM); 1♀, Kanangra-Boyd National Park, 1 km N of Boyd River Bridge, Sept. 2005, D.K.M. (AM). Australian Capital Territory: 1♂, 1♀, Black Mountain, Canberra, May 1980, D.H.C. (ANIC); 1♀, Picadilly Circus, Brindabella Range, 800 m, April 1978, S.B.P., J.K-P. (ANIC).

Other material (localities only given). Queensland: “Nat. Park” [i.e. Lamington National Park, Macpherson Range] (UQ). New South Wales: Wright’s Lookout, New England National Park (AM). Victoria: Mallacoota National Park (ANIC); Mount Donna Buang, near Warburton (AM); Cement Creek, near Warburton (ANIC).



Figs 61–63. (61) *Borboroides perkinsi*, part of male postabdomen, left lateral view; scale = 0.2 mm. (62) Aedeagus of same, left lateral view; scale = 0.1 mm. (63) Wing of same. *c*, cercus; *e*, epandrium; *g*, gonite; *hu*, hump on anteroventral bridge of epandrium; *sc*, scabrous process of hypandrium (paired); *ss*, surstylus; *ssa*, apodeme of surstylus (internal); *s8*, sternite 8.

Description (male, female). Moderately small, slightly elongate, partly shining, dark brownish fly.

Coloration (older specimens often paler than indicated). Head tawny-yellow; posterior part of postfrons and upper occiput brown to blackish; postfrons pruinulent anteriorly, more shining posteriorly; face glabrous and glossy on most of surface. Antenna largely tawny-brown; segment 3 predominantly dark brown; segment 5 yellow; segment 6 white or creamy-white. Prelabrum yellow to tawny-yellow; palpus dark brown to tawny brown. Thorax largely shining black to dark brown; mesoscutum and scutellum thinly pruinulent; lateral margin of mesoscutum and propleuron tawny-yellow. Legs largely brown to tawny brown; coxae yellowish; fore tarsus dark brown. Wing: veins brown; membrane with slight yellow-brown tinge. Halter pale tawny with creamy-white capitellum. Abdomen brown; in male, anterior part of protandrium, posterior part of epandrium, and cercus yellow; in female, cercus pale yellow.

Head c. as long as high, slightly angular in profile at junction of postfrons and face; postfrons weakly setulose anteriorly; face receding below on much of surface, but with slightly projecting lower margin; height of cheek 0.22–0.33 of height of eye; ocellar bristle slightly longer than posterior fronto-orbital; anterior fronto-orbital bristle absent or scarcely differentiated from setulae; postvertical bristle small. Antenna: segment 3 porrect, longer than deep, slightly longer in male than in female; arista with pubescence longer and denser than in other *Borboroides* spp. Prelabrum moderately large and prominent in female, smaller, less prominent, and separated from face by membranous band in male.

Thorax. Mesoscutum with two or three small setulae towards each lateral margin, but rest of surface, including intradorsocentral region, quite without setulae; mesopleuron with two or three posterior setulae; dorsocentral bristles three, anterior one at least 0.7 of length of posterior one, situated well in front of transverse suture; presutural and anterior notopleural bristles very long; humeral and posterior notopleural bristles small; posterior intra-alar bristle distinct; one sternopleural bristle present. Legs more elongate than in most other *Borboroides* spp.; fore basitarsus relatively slender; hind basitarsus at least half as long as hind tibia, generally longer in males; fore femur with two or three long posteroventral bristles and c. three long posterodorsal bristles, without anteroventral bristles; mid femur with c. three anterior bristles on its distal third; hind femur with large anterodorsal preapical bristle and one or two small subapical bristles; mid tibia with two large preapical dorsal bristles and a small anterior bristle slightly basad of these, also with two unequal subapical ventral spurs and vestigial subapical anterior spur; hind tibia without subapical spur. Wing rather elongate, slightly narrowed basally, with relatively narrow alula; costal setulae on region of costal cells all small; costa noticeably weakened beyond humeral crossvein; subcosta with slight indication of weakening near same level; anterior crossvein meeting vein 4 well before mid-length of discal cell; vein 2 on much of length almost parallel with vein 3, diverging at apical extremity; apical section of vein 4 1.6–2.0× as long as penultimate section; basal crossvein oblique; penultimate section of vein 5 almost straight; discal and anal cells narrow (particularly relative to those of *atra* group); apical section of vein 6 slightly curved towards posterior margin, extending about two thirds distance from anal crossvein to margin, distally terminating abruptly.

Abdomen. Tergite 5 shorter than tergite 4 in both sexes; sternite 1 reduced, sclerotized only at sides; in male, sternite 5 shorter than sternite 4. Male postabdomen: epandrium only slightly asymmetrical; sternite 6 almost encircling postabdomen, less developed on right side, on ventral part symmetrical with pair of narrow anterior extensions as in *B. atra*; segment 8 elongate, curved, slightly clavate posteriorly, extensively sclerotized ventrally, with lateral ridge on each side of anterior half and scattered setulae; epandrium elongate, but with large rounded median hump on anteroventral bridge, with numerous moderately short setulae and one large bristle on each side of anteroventral hump; surstylus divided into two lobes from a little beyond base, which shows no definite line of articulation with margin of surstylus; outer lobe broad, truncate, incurved distally, with several large setulae on outer surface; inner lobe of surstylus long, slender, with three short, stout spinules on distal part; hypandrium with two pairs of processes; anterior process (gonite) setulose and with two long terminal bristles, inner bristle minutely curled at apex, outer bristle with preterminal nodule; posterior process of hypandrium densely scabrous with covering of short denticles and minute microtrichia; aedeagus largely sclerotized, somewhat T-shaped, with basal shaft and anterior and posterior distal extensions; basal shaft c. as long as cercus, with pair of densely minutely microtrichose ridges on lateral margins of anterior face, and beyond these a pair of largely smooth lamellae; anterior extension elongate, apparently with terminal gonopore; posterior extension of aedeagus with tuft of long pubescence near base of distal surface, otherwise smooth, with rounded, solid apex; aedeagus apodeme elongate; cercus ovate, distally rounded, with scattered setulae on posterior (outer) surface, on anterior surface with a short, rounded sub-basal lobe bearing short, stout setulae on its margin. Female postabdomen: tergites and sternites of segments 6 and 7 only moderately reduced in size; cercus moderately short.

Dimensions. Total length, ♂ 2.1–2.7 mm, ♀ 2.4–2.8 mm; length of thorax, ♂ 0.99–1.10 mm, ♀ 1.0–1.2 mm; length of wing, ♂ 3.0–3.4 mm, ♀ 3.2–3.6 mm.

Distribution. Queensland (southeastern border district) to eastern Victoria—cooler districts.

Notes

Borboroides perkinsi is a morphologically isolated species in the genus *Borboroides*, though by no means the only such species. The following conditions in *B. perkinsi* distinguish it from all other *Borboroides* spp: the face is largely glossy and devoid of pruinescence (other species have the face entirely thinly to densely pruinulent); the arista is pale, with segment 6 white or almost so (other species have the arista strongly brown-pigmented); the dorsocentral bristles are all long, with the arrangement 1+2 (in no other species are there three such long dorsocentrals, and none has the arrangement 1+2); mesoscutal setulae are quite absent (all other species have at least the central anterior part of the mesoscutum with numerous setulae); the hind basitarsus is at least half as long as the hind tibia (less than half as long as hind tibia in other species). The five above character states are all probable autapomorphies for *B. perkinsi* and do not indicate what its closest relatives may be. *Borboroides perkinsi* also shows marked specific peculiarities of the male

postabdomen, but numerous other species of the genus have their own unique conditions. We may note for *B. perkinsi* the following features: anteroventral bridge of epandrium with large rounded hump; hypandrium with pair of densely scabrous processes; aedeagus T-shaped in lateral view.

In *B. perkinsi* the nature of the glandular region of the hind femur, the proportions of wing veins and cells, and the sexual dimorphism in antennal segment 3 agree with the *stewarti* group, but the abruptly truncated vein 6 and presence of mesopleural setulae disagree with this group. The reduced, bipartite abdominal sternite 1 disagrees with the *atra* group, but is in general agreement with other groups. As agreement of *B. perkinsi* with the *stewarti* group is ambiguous and could be due to plesiomorphies, I place it in the monotypic *perkinsi* group.

Borboroides perkinsi has occasionally been collected at both wombat dung and carrion.

The specific epithet refers to F. Athol Perkins, formerly of University of Queensland, who collected this species in Queensland in 1935 and later made specimens available for study.

Staniochi group

Diagnostic description. Only posterior fronto-orbital bristle large, anterior one vestigial, or up to c. half as long as posterior one and reclinate; antennal segment 3 only slightly longer than deep, somewhat decumbent; mesoscutum with numerous setulae; three dorsocentral bristles present, all behind transverse suture; propleuron with dense pruinescence reaching border of fore-coxal foramen; mesopleuron with several setulae; mid tibia with one or two anterior to anterodorsal bristles basad of level of preapical dorsal pair, and variable armature of subapical spurs; length of discal cell along vein 5 much less than 3× distance of its posterodistal angle from margin, latter distance measured in direction of distal section of vein 5; section of vein 5 on discal cell curved for most of length; distal section of vein 6 sclerotized, more than twice as long as well sclerotized posterior crossvein, distally almost straight; abdominal sternite 1 divided by median desclerotization.

Included species. *Borboroides dayi* n.sp., *B. staniochi* n.sp.

Borboroides dayi n.sp.

Figs 64–69

Material examined. HOLOTYPE. ♂, New South Wales: Boyd River crossing, Kanangra-Boyd National Park, 13.iv.2004, D.K.M. (AM K219748). Mounted on card point. PARATYPES. New South Wales: 1 ♂, same data as holotype (AM); 3 ♀♀, Mount Wilson, Blue Mountains, April, Sept. 2002–2005, D.K.M. (AM); 2 ♂♂, Sawpit Creek, Snowy Mountains, Feb. 1979, D.K.M., B.J.D. (AM). Australian Capital Territory: 1 ♂, Gibraltar Creek, Jan. 1978, Z.R.L. (ANIC).

Other material. Victoria: 3 ♂♂, near Mount Juliet, 9 km E of Healesville, April 2003, B.J.D., D.K.M. (AM, MV); 3 ♂♂, 15 ♀♀, lower reservoir, Falls Creek, Trawool, Jan. 2005, D.R.B. (AM, ANIC, MV).

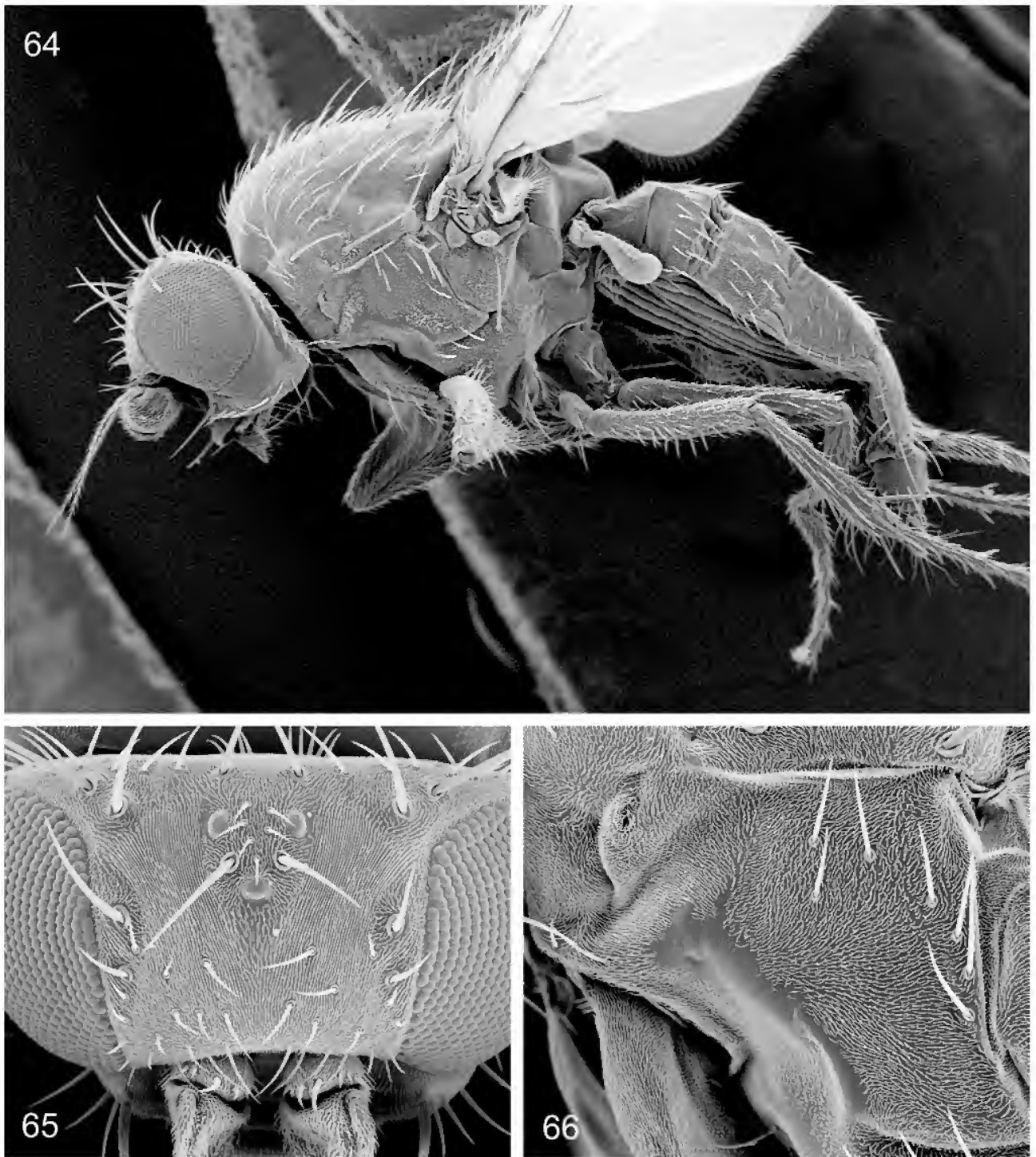
Description (male, female). Very small, largely black fly, with unmarked wings, very similar to *B. staniochi* and agreeing with description of that species, except as indicated below.

Coloration. Postfrons with tawny-orange anterior margin, elsewhere almost entirely grey-pruinescent, apparently with fingerprint sculpture less developed than in *B. staniochi*; face and cheek region largely tawny-yellow in male, generally much darker in female. Prelabrum tawny to brown in male, brown to black in female. Mesoscutum more densely brown-pruinescent than in *B. staniochi*; mesopleuron very extensively grey-brown-pruinescent, with glossy zone narrow, restricted to anteroventral part but widely separated from margin of fore-coxal foramen.

Head. Height of cheek 0.26–0.30 of height of eye; anterior fronto-orbital bristle reclinate, c. half as long as posterior one or slightly less. Prelabrum of female broad, moderately deep and prominent, smaller in male.

Thorax. Intradorsocentral setulae in six to eight irregular rows; one large posterior sternopleural bristle present and two or three large setulae in front of it. Hind femur with anterodorsal bristle often indistinct; fore and hind tibiae each with distinct but not large preapical dorsal bristle; mid tibia with two longitudinally aligned anterodorsal bristles below level of preapical dorsal pair, the more distal one larger, proximal one rarely absent (as in smallest male), also with the following subapical spurs in both sexes: large anterior, large ventral, moderately large posterior one; hind tibia with apical anteroventral spur very small, but stouter than adjacent setulae. Wing: apical section of vein 4 c. 3.2–3.5 times as long as penultimate section; distal section of vein 5 straight or almost so; distal section of vein 6 extending c. 0.75–0.80 of distance from anal crossvein to margin.

Abdomen. In male, tergite 5 distinctly smaller than tergite 4; sternite 5 much shorter than tergite 5, not medially narrowed, posteromedially with group of mostly short, slightly spinescent setulae, with a series of longer setulae laterally. Male postabdomen: tergite 6 absent; spiracles 6 and 7 present on both sides; sternite 6 (anterior part of protandrial synsternite) with dark, strongly sclerotized anterior band encircling postabdomen, ventrally glabrous, but with little pruinescence between median ventral part and sternite 7; sternite 7 rather small, compact, glabrous, lateroventral in position; sternite 8 shorter and stouter than in *B. staniochi*, subconical, sclerotized and pruinescent all round, except for posteroventral bight, with few stout posterodorsal and posterolateral setulae, and pair of lateroventral setulae near mid-length; epandrium rather large and stout, narrowed at anterior extremity, extensively coarsely setulose, with well-developed anteroventral bridge; surstylus rather broad basally but without posterobasal foot, evenly tapered to narrowly obtuse apex, with few setulae mainly on anterior and distal surfaces, with only two to four small spinules restricted to inner surface at apex; gonite large, subcylindrical, setulose, without sub-basal gibbosity; aedeagus moderately short, stoutly tongue-shaped, its cuticle with many fine sclerotized ridges which are dense and parallel towards base, apically and anteriorly with fine hispid microtrichia, with posterior section of smooth, transparent, inflatable cuticle; basiphallus without processes; aedeagal apodeme long and rather stout; cerci quite small, obovoid, separate but approximated to each other, remote from bases of surstyli, each with few long setulae.



Figs 64–66. (64) *Borboroides dayi*, female. (65) Dorsal view of head of same. (66) Left propleural and mesopleural regions of thorax of same.

Dimensions. Total length, ♂ 1.6–2.0 mm, ♀ 1.5 mm; length of thorax, ♂ 0.72–0.94 mm, ♀ 0.84 mm; length of wing, ♂ 1.5–1.8 mm, ♀ 1.8 mm.

Distribution. New South Wales: Central and Southern Tablelands divisions. Australian Capital Territory: Canberra district. Victoria: Yarra Valley and Seymour district.

Notes

Borboroides dayi is most similar to *B. staniochi* as indicated in the key to species. The main differentiating characters are given under that species.

Compared with *B. staniochi*, *B. dayi* has a wide distribution, but is known from cooler habitats. Most specimens have been collected at wombat dung bait, and probably all are from natural wombat habitats.

The specific epithet refers to Barry J. Day, who has done much collecting for this project.

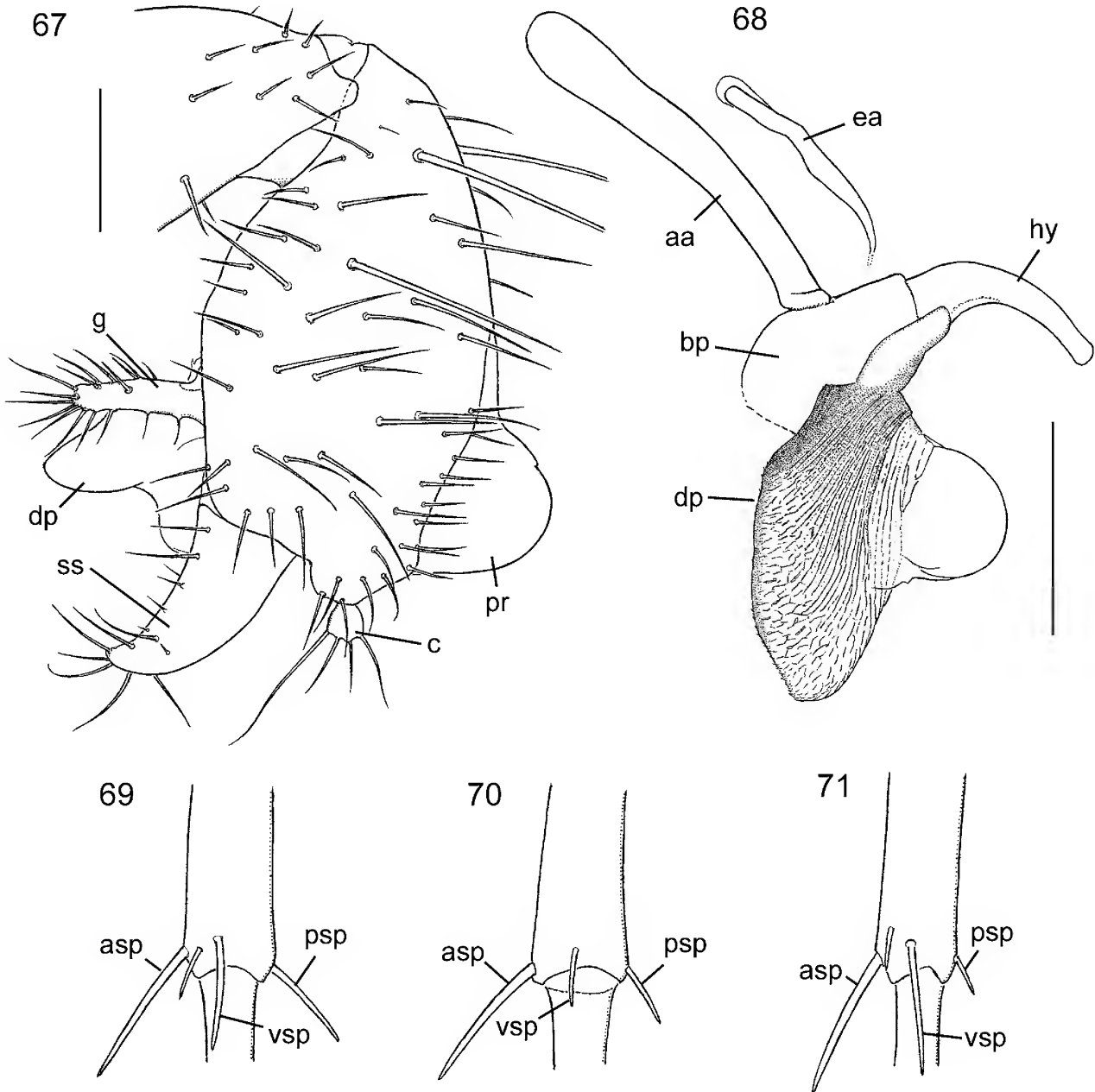
***Borboroides staniochi* n.sp.**

Figs 70–79

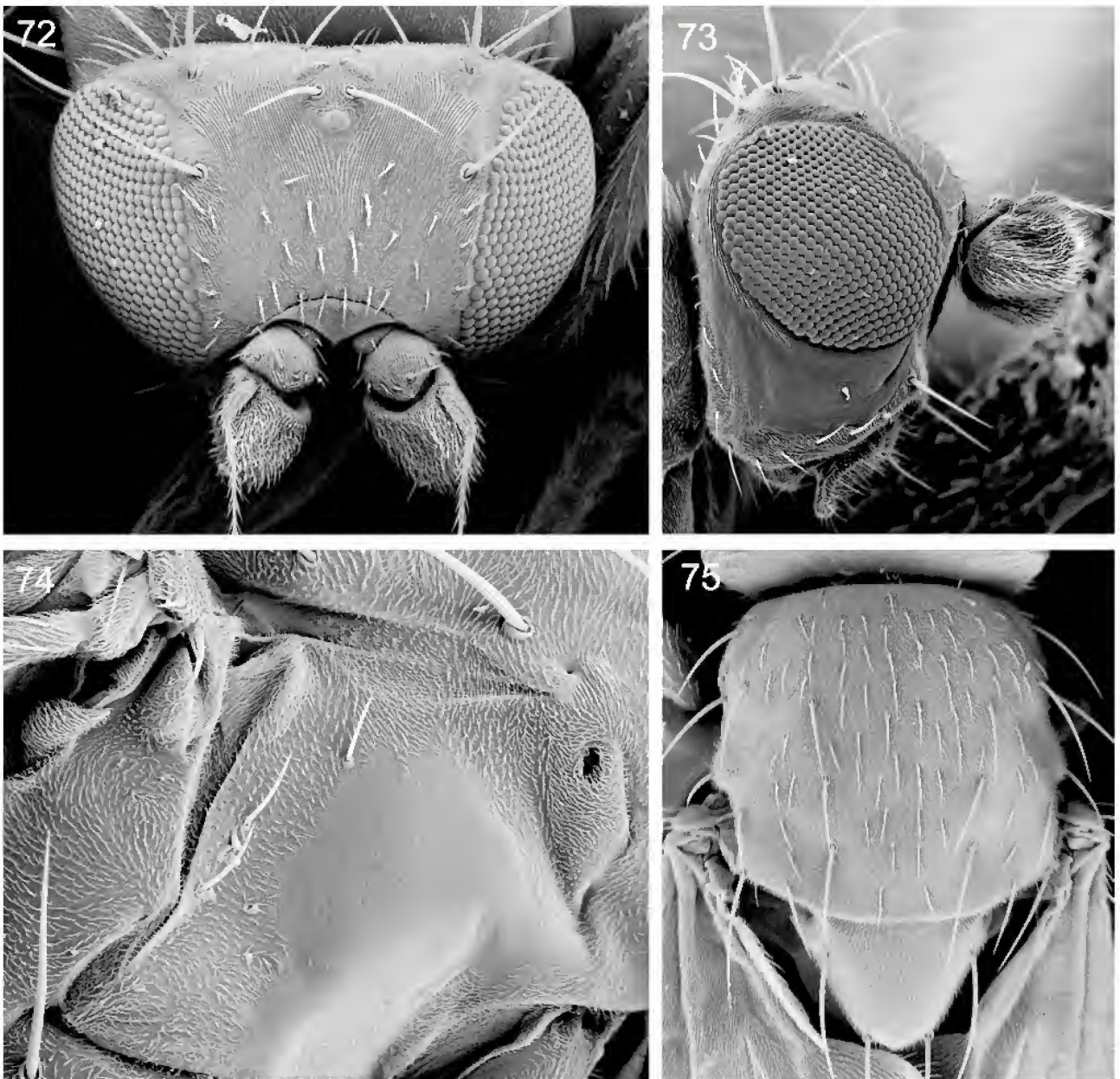
Material examined. HOLOTYPE. ♂, New South Wales: Putty Road, 41 km N of Colo R. bridge, 33°11'S 150°41'E, c. 220 m, [Yengo National Park], 6.vi.2002, D.K.M. (AM K219749). Mounted on card point. PARATYPES. New South Wales: 17♂♂, 12♀♀, same locality as holotype, May, June 2002–2004, D.K.M. (AM, ANIC, USNM).

Description (male, female). Very small, stout, largely black fly with unmarked wing.

Coloration. Head, thorax, legs and abdomen black to dark brown. Postfrons without glossy zones, extensively pruinose but more sparsely so centrally and posteriorly where surface shows strong fingerprint sculpture (Fig. 72); lower margin of cheek narrowly grey-pruinose. Antenna: segment 1 tawny-yellow; segment 2 dark brown; segment 3 brown with variable tawny zone near base. Prelabrum blackish; palpus brown-black. Mesoscutum largely thinly pruinose, shining; scutellum more densely brown-pruinose; mesopleuron glossy brown-black centrally, the glossy zone extending narrowly to lower margin and to anteroventral extremity, upper and posterior margins broadly greyish-pruinose; sternopleuron, pteropleuron,



Figs 67–71. (67) *Borboroides dayi*, epandrium and associated structures, left lateral view; scale = 0.1 mm. (68) Aedeagus and associated structures of same, left lateral view; scale = 0.1 mm. (69) *B. dayi*, male, diagram of apical part of right mid tibia, ventral view. (70) *B. staniochi*, male, the same. (71) *B. staniochi*, female, the same. *aa*, aedeagal apodeme; *asp*, anterior subapical spur; *bp*, basiphallus (partly concealed); *c*, cercus; *dp*, distiphallus; *ea*, ejaculatory apodeme; *g*, gonite; *hy*, median posterior sclerite of hypandrium; *pr*, proctiger; *psp*, posterior subapical spur; *ss*, surstylus; *vsp*, ventral subapical spur.



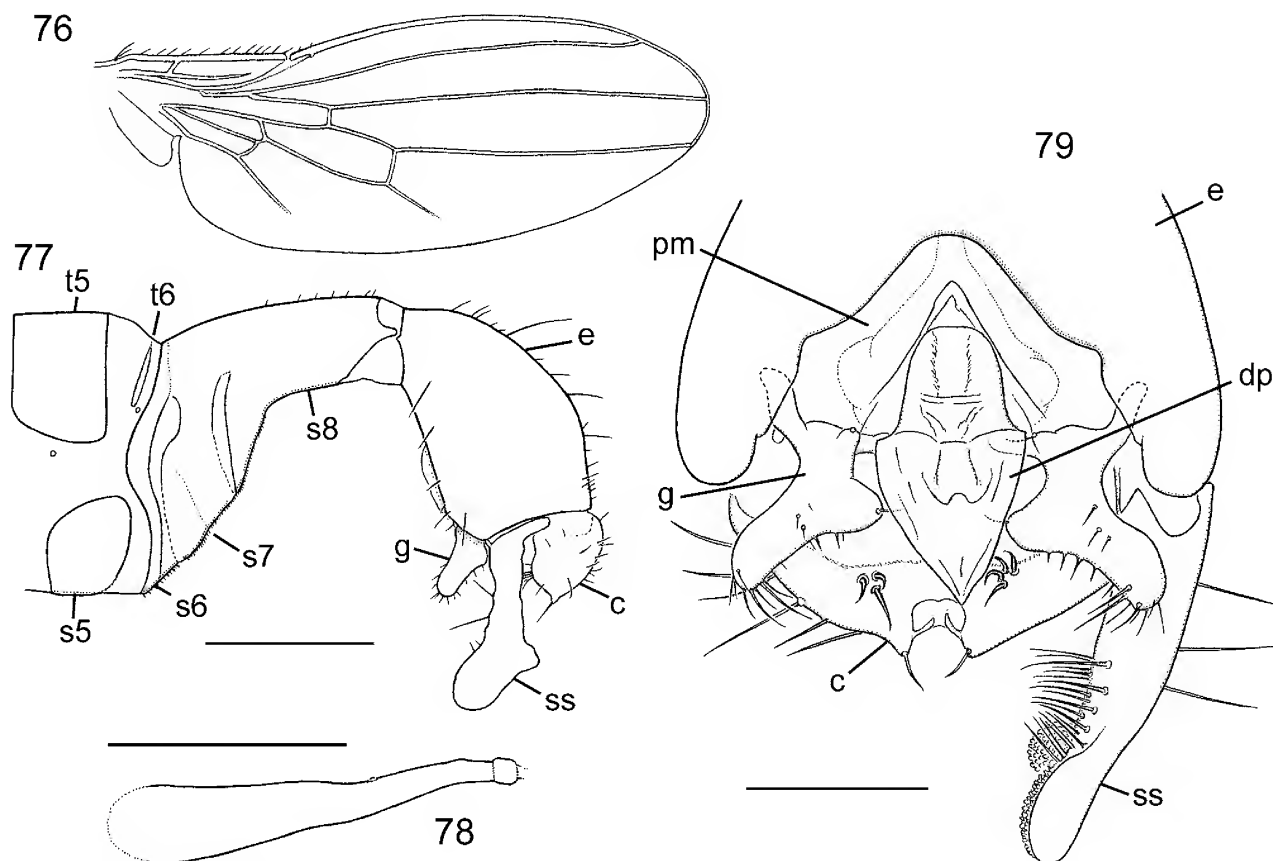
Figs 72–75. (72) *Borboroides staniochi*, frontal view of head. (73) The same, lateral view of head. (74) The same, right mesopleural region of thorax. (75) The same, dorsal view of thorax.

and pleurotergite grey-pruinose. Legs, including tarsi, dark brown; bases of tibiae often narrowly tawny. Wing membrane faintly smoky, without paler or darker zones. Halter brown, with creamy-white capitellum. Abdominal tergites with thin brown pruinescence.

Head higher than long; eye subcircular, apparently bare; postfrons with numerous erect to somewhat proclinate setulae on anterior half; face concave, particularly on lower part; height of cheek 0.41–0.56 of height of eye; postvertical bristle slightly shorter than posterior fronto-orbital; ocellar bristle large; posterior fronto-orbital bristle moderately long, reclinate and slightly sloped outwards; anterior fronto-orbital similarly inclined but very small, often as long as adjacent setulae. Antenna: segment 3 ovoid, not decumbent; arista distinctly longer than greatest diameter of eye, with moderately dense short hairs, not longer than maximum diameter of segment 5. Prelabrum narrow, not prominent,

slightly larger in female than in male; palpus moderately short; proboscis short, with broadly rounded labella.

Thorax moderately stout; intradorsocentral setulae in six irregular rows anteriorly, sparser posteriorly; mesopleuron with few posterior setulae; the following thoracic bristles present: humeral, presutural, 1+1 notopleurals, supra-alar, postalar (near apex of postalar callus), posterior intra-alar, 0+3 well-developed dorsocentrals, two pairs of large scutellars, small anterior sternopleural and larger posterior one. Fore femur with three or four posteroventral bristles, of which at least two are moderately long, and usually two long posterodorsal bristles on distal part; mid femur with three to six anterior bristles on distal half; hind femur with anterodorsal to dorsal bristle near apical fifth of length; fore tibia with preapical dorsal bristle indistinct or absent; mid tibia with only one, rather short anterodorsal bristle near mid-length, pair of stout preapical dorsal bristles



Figs 76–79. (76) *Borboroides staniochi*, wing. (77) Male postabdomen of same, left lateral aspect; scale = 0.2 mm. (78) Ejaculatory apodeme of same; scale = 0.05 mm. (79) Epandrial and hypandrial structures of same, anteroventral view, right surstylus, setulae on epandrium, and marginal setulae on left cercus omitted; scale = 0.1 mm. *c*, cercus; *dp*, distiphallus; *e*, epandrium; *g*, gonite; *pm*, prehypandrial membrane; *ss*, surstylus; *s5*–*s8*, sternites 5–8; *t5*, *t6*, tergites 5 and 6.

near apical fifth, and with following subapical spurs: large anterior, vestigial posterior, in female only large ventral; hind tibia with preapical dorsal bristle and quite small but often distinct apical anteroventral spur. Wing: costa without special armature; subcosta weakened near level of humeral break of costa, well sclerotized for short distance beyond; anterior crossvein meeting vein 4 near mid-length of discal cell; apical section of vein 4 *c.* 3.4–4.3× as long as penultimate section; basal crossvein moderately oblique, making distinct angle with moderately curved section of vein 5 on discal cell; apical section of vein 5 very slightly curved; anal crossvein curved; distal section of vein 6 extending *c.* two thirds of distance from anal crossvein to margin or almost so, well sclerotized approximately straight.

Abdomen. Sternite 1 sclerotized at sides, attenuated (almost desclerotized) medially; tergite 5 slightly shorter than tergite 4 in female, subequal to it in male. Male postabdomen: sternite 5 extensively sclerotized on each side, but narrowed and weakly sclerotized medially; tergite 6 reduced to small separate strip on each side, with spiracle near its lower extremity in membrane; compound protandrial sclerite (synsternite 6–8) becoming rather slender and tubular posteriorly; anterior margin of sternite 6 marked by strongly sclerotized dark band more or less encircling postabdomen, but less distinct and sclerotized on right side; sclerotization of sternite 7 most distinct on left side; ventral region of sternites 6 and 7 extensively densely microtrichose; length

of synsternite on median dorsal line more than twice that of tergite 5; epandrium rather stout, moderately narrowed anteriorly, its anteroventral bridge at narrowest (on median line) *c.* 0.2 of total length of epandrium; prehypandrial membrane with many minute combs of slender microtrichia, except at sides; surstylus large, with small posterobasal foot, greatly expanded distally and obliquely subtruncate, with few setulae before and near mid-length, dense comb of setulae on inner surface near commencement of expansion, and many minute, blunt, crowded spinules on inner surface near distal margin; gonite large, complex, with anterobasal mammiliform process, similar but larger medial process, and rounded setulose apex; aedeagus short, concealed between lateral processes, with short, largely membranous distiphallus and long, slender apodeme; cerci joined by membrane for most of length, and by pigmented sclerotized anterior bar just before apices, each cercus, in posterior view, very broad, with acute apex, with scattered small setulae, a prominent apical setula, and a dense tuft of coarse setulae on anterior surface.

Dimensions. Total length, ♂ 1.4–1.9 mm, ♀ 1.4–1.9 mm; length of thorax, ♂ 0.66–0.78 mm, ♀ 0.69–0.86 mm; length of wing, ♂ 1.6–1.8 mm, ♀ 1.8–2.2 mm.

Distribution. New South Wales: lowlands of Colo River district, between Blue Mountains and Hunter Valley. Only known from the type locality.

Notes

Borboroides staniochi belongs in the *staniochi* group as indicated by the compact discal cell bordered by a strongly curved section of vein 5, reduced anterior fronto-orbital bristle, and absence of any glossy zone on the postfrons. Within this group it is distinguished from *B. dayi* by the less restricted shining zone on the mesopleuron; the presence on the mid tibia of only one anterodorsal bristle (in addition to the preapical dorsal pair), at most only a very small posterior subapical spur, and, in the male, the absence of the subapical ventral spur; the slightly shorter vein 6; the smaller prelabrum (the difference more obvious between females); and, in the abdomen of the male, the medially attenuated sternite 5, the broadly, asymmetrically spatulate surstylus, the broad cercus, and the broad, complex gonite (Figs 77, 79).

All specimens were collected around wombat dung bait in a natural wombat habitat.

The specific epithet refers to Damien Stanioch, formerly of Wonderland Sydney, whose co-operation led to the discovery of this and several other species of *Borboroides*.

Helena group

Diagnostic description. Only posterior fronto-orbital bristle well developed, anterior one minute or absent; antennal segment 3 slightly longer than deep, slightly decumbent; mesoscutum with numerous setulae; three dorsocentral bristles usually present, all behind transverse suture, but only posterior one large; ventral part of propleuron bordering fore-coxal foramen entirely glossy; mesopleuron with several setulae; mid tibia with one or two anterior bristles basad of level of preapical dorsal pair, also subapical anterior spur, but presence of other subapical spurs variable; length of discal cell along vein 5 much less than 3× distance of its posterodistal angle from margin, latter distance measured in direction of distal section of vein 5; section of vein 5 on discal cell curved for most of length; distal section of vein 6 sclerotized, c. twice as long as well sclerotized posterior crossvein, almost straight; abdominal sternite 1 divided by median desclerotization.

Included species. *Borboroides helenae* n.sp., *B. dorenae* n.sp.

Borboroides helenae n.sp.

Figs 4–6, 80–84

Material examined. HOLOTYPE. ♂, New South Wales: Mount Wilson [Blue Mountains; Waterfall Reserve, c. 900 m, 33°31'S 150°23'E], 6–7.v.2002, D.K.M. (AM K219750). Mounted on card point. PARATYPES. New South Wales: 4♂♂, 2♀♀, Mount Wilson, May, Aug. 2002, D.K.M. (AM, BM); 2♀♀, Putty Road, 41 km N of Colo River bridge, May, June, 2002–2003, D.K.M. (AM); 2♂♂, Colo Heights, May 2002, D.K.M. (AM); 6♂♂, 6♀♀, Kanangra Road, 14.2 km S of Oberon–Jenolan road junction, April 2002, B.J.D., D.K.M. (AM, USNM); 12♂♂, 10♀♀, Boyd River crossing, Kanangra–Boyd National Park, April 2002–2004, B.J.D., D.K.M. (AM, TDPI); 4♂♂, 1♀, 5 m(iles) [c. 8 km]

S of Monga, Braidwood district, May 1968, D.H.C., Z.R.L. (ANIC). Australian Capital Territory: 4♂♂, 1♀, Mount Coree, April 1968, D.H.C. (ANIC).

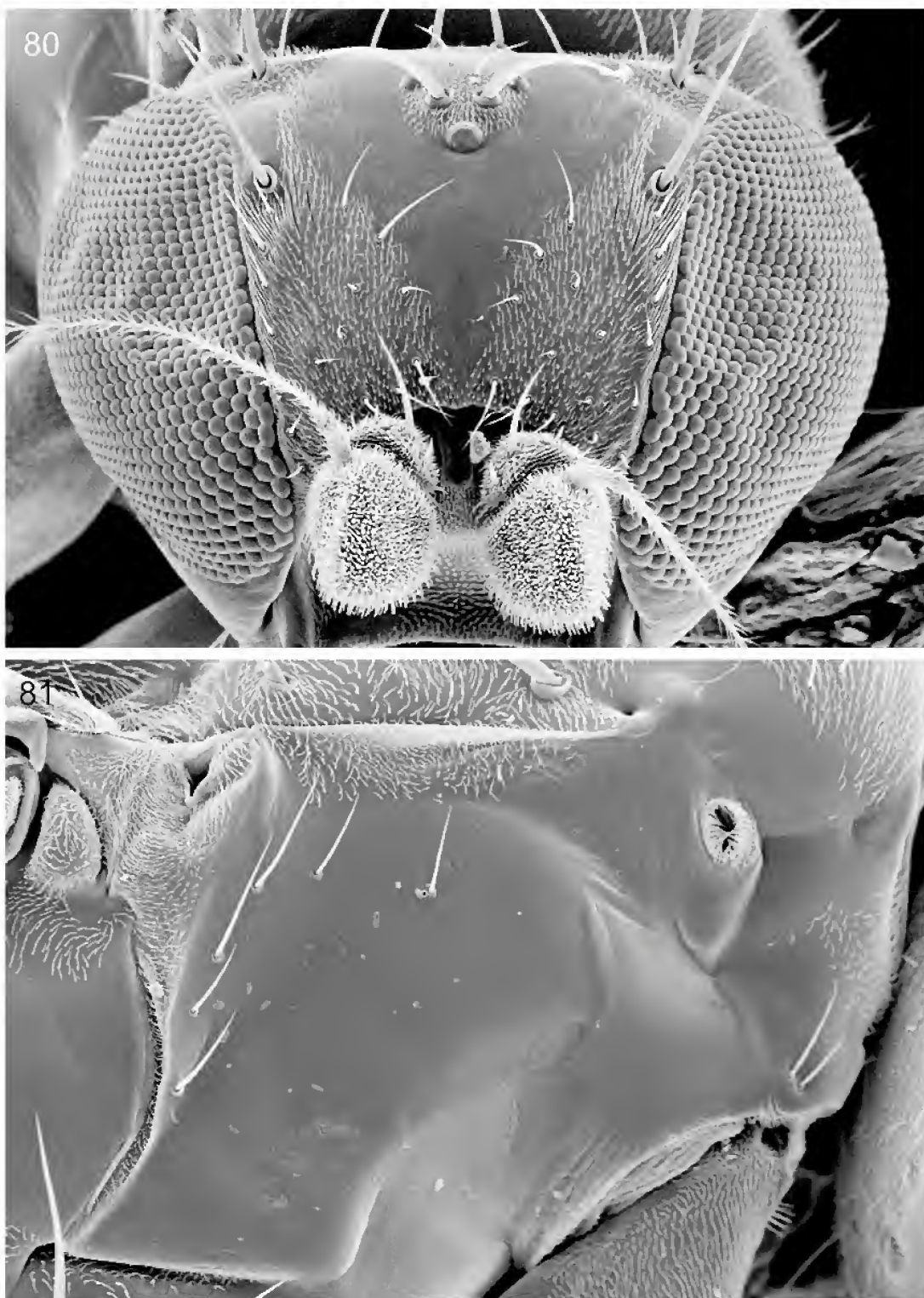
Other material (localities only given). Victoria: 7 km S of turnoff to Cape Conran from Prince's Highway, Orbost district (AM); Providence Ponds Reserve, 32 km W of Bairnsdale (AM); 11 km E of Warburton (AM, MV); Mount Donna Buang, near Warburton (AM, MV); Dom Dom Saddle, 17 km NE of Healesville (AM); Fernshaw, 6 mi [c. 10 km] NE of Healesville (AM); near Mount Juliet, 9 km E of Healesville (AM, CNC, BM). Tasmania: Ferntree, near Hobart (AM).

Description (male, female). Small largely black, partly shining fly with unmarked wing.

Coloration. Head largely black; postfrons orange-fulvous anteriorly, with large subtriangular glossy blackish zone from vertex to mid-anterior region, outside this zone greyish-pruinescent; face tawny-yellow, pruinescent; cheek tawny, subshining. Antenna tawny to yellowish, segment 3 partly blackish. Male: prelabrum tawny-yellow; palpus pale yellow. Female: prelabrum tawny-brown; palpus dark grey-brown. Thorax black; mesoscutum and scutellum with almost uniform covering of greyish pruinescence; mesopleuron shining black, with small zone of yellow-grey pruinescence on upper margin, none on posterior margin; sternopleuron largely shining black with very little pruinescence near coxa; hypopleuron shining brown-black, with little yellowish anterodorsal pruinescence in male, with additional zone of greyish pruinescence posteriorly, narrowly separated from posterior margin. Legs largely brown to blackish; fore coxa, trochanter and base of femur yellowish; mid tarsus yellowish brown on variable extent. Wing membrane tinged with brownish yellow; veins yellowish brown. Halter yellowish brown, with grey-brown capitellum. Abdomen black, largely shining; tergites 1–3 with broad grey-pruinescent median zones; in male epandrial sclerite brown-pruinescent; epandrium predominantly glossy; in female tergite 6 with some brown pruinescence medially.

Head higher than long; eye slightly higher than long; postfrons with setulae on anterior half mostly inclined forwards and mesad, some tending to form pair of imperfectly differentiated anteriorly convergent series (somewhat resembling interfrontal bristles of sphaerocerines); face concave; height of cheek 0.27–0.33 of height of eye; ocellar bristle longer than major fronto-orbital; posterior fronto-orbital reclinate and slightly inclined outwards; anterior fronto-orbital not or only slightly differentiated from reclinate orbital setulae. Antenna: segment 3 short-oval, almost horizontal; arista distinctly longer than greatest diameter of eye, with numerous short hairs extending to apex. Prelabrum small in male, larger and moderately prominent in female; palpus moderately short and slender.

Thorax moderately stout; intradorsocentral in four rows; scutellum without setulae; mesopleuron with several setulae, mainly on upper posterior quarter; the following bristles present: humeral, small presutural, 1+1 notopleurals, supra-alar, postalar, posterior intra-alar, one larger and two small dorsocentrals, two pairs of scutellars, rather large posterior sternopleural and one or two smaller anterior ones. Fore femur with five or more long posteroventral bristles and few posterodorsal bristles, without anteroventral bristles; mid femur slightly curved, more so in male, with a series of



Figs 80–81. (80) *Borboroides helenae*, head, anterior view. (81) The same, right propleural and mesopleural region of thorax.

seven or more rather short anterior bristles and, in male only, a variable number of long fine ventral bristles or hairs; hind femur with one preapical dorsal bristle; fore tibia lacking smooth longitudinal ridges as described for male of *B. doreenae*, with slightly differentiated preapical dorsal bristle; mid tibia with pair of approximated preapical dorsal bristles, usually two anterior bristles basad of these, one anteroventral and one posterior subapical spur, in male only numerous long

ventral mollisetae; in female only a long apical ventral spur; hind tibia with moderately long preapical dorsal bristle and at most vestigial anteroventral subapical spur. Wing: costa with setulae on second costal cell more than half as long as width of that cell; section of subcosta on second basal cell sclerotized for c. two thirds length of that cell; anterior crossvein meeting vein 4 near or slightly beyond mid-length of discal cell; vein 2 distally almost parallel with vein 3 or



Fig. 82. *Borboroides helenae*, male, mid legs, anterior view; epandrium in background.

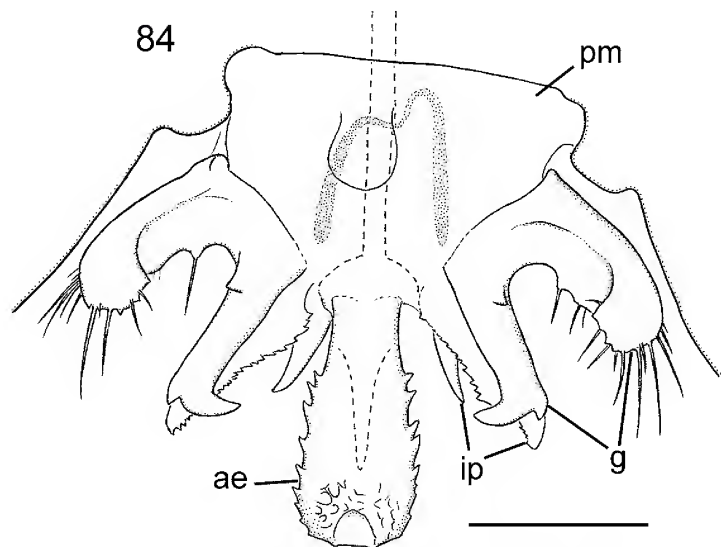
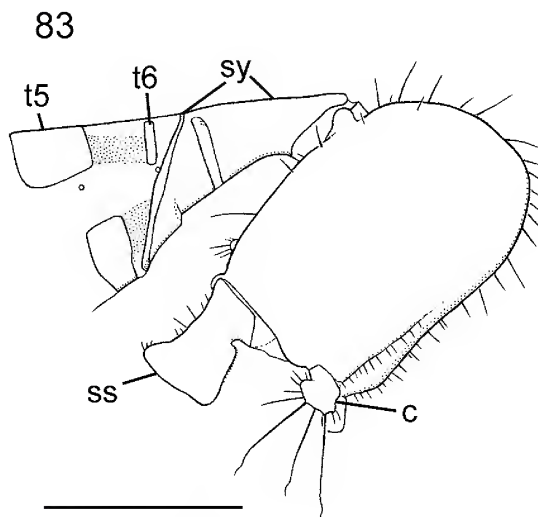
slightly diverging; apical section of vein 4 = 3.4–4.3 times as long as penultimate section; basal crossvein slightly oblique, not aligned with penultimate section of vein 5; curvature of vein 5 along discal cell relatively slight; anal crossvein oblique for most of length, curved anteriorly; distal section of vein 6 slightly more than twice as long as anal crossvein.

Abdomen. Sternite 1 divided into pair of widely separated lateral sclerites; additional minute sclerotized transverse bar present on median line between sternite 1 and sternite 2; tergite 5 much shorter than tergite 4 in male, only slightly shorter in female. Male postabdomen: tergite 5 joined to

tergite 6 by a pigmented band on each side; sternite 5 of moderate size, narrowed medially, joined to protandrial sternite complex by a pigmented zone on each side; tergite 6 small, divided in two; protandrial sternite complex slender, approximately symmetrical, with anterior band of sternite 6 equally dark and sclerotized on each side, without ventrolateral angle or prominence on each side; spiracle 7 vestigial, apparently closed; epandrium large and inflated, as long as preabdomen, usually appearing pointed in dried specimens through partial collapse, with very broad anteroventral bridge in front of hypandrium; surstylus broad, truncate distally, notched posteriorly at base, on inner surface with setulae anteriorly and many blunt spinules posteriorly; anteromedian part of prehypandrial membrane with many comb-like groups of short microtrichia; hypandrial structure very complex (Fig. 84), with three pairs of diversely shaped processes, of which only the setulose deeply bilobed gonite is obviously homologous with any structure in other species of *Borboroides*; posterior median dark blade-like process or epiphallus extensively attached to base of aedeagus; aedeagus without clear division into basiphallus and distiphallus, clavate, well sclerotized, with terminal gonopore, lateral tubercles having basally directed points, and roughening near gonopore which suggests flat scales; aedeagal apodeme long, apparently free; prehypandrial membrane enclosing a lightly pigmented, probably soft, irregularly U-shaped strip; cerci short, not compressed, well separated, articulated with epandrium, with short setulae and few longer terminal mollisetae. Female postabdomen: tergite 6 short, transverse, undivided.

Dimensions. Total length, ♂ 2.1–2.3 mm, ♀ 2.3–2.6 mm; length of thorax, ♂ 0.96–1.1 mm, ♀ 0.99–1.2 mm; length of wing, ♂ 2.3–2.7 mm, ♀ 2.5–2.8 mm.

Distribution. New South Wales: mainly highlands; also Colo River district. Australian Capital Territory: Brindabella Range. Victoria: widely distributed in eastern half of state. Tasmania: Hobart district, single record.



Figs 83–84. (83) *Borboroides helenae*, male postabdomen, left lateral view; scale = 0.5 mm. (84) Hypandrial complex of same, anteroventral view; scale = 0.1 mm. *ae*, aedeagus; *c*, cercus; *g*, gonite; *ip*, inner hypandrial processes (two pairs); *pm*, prehypandrial membrane; *ss*, surstylus; *sy*, protandrial synsternite; *t5*, *t6*, tergites 5 and 6.

Notes

Among the species with only one well-developed fronto-orbital bristle and relatively short discal cell (*staniochi* and *helenae* groups), *B. helenae* is distinguished by the more extensively glossy thoracic pleura, there being no obvious pruinescence on the posterior margin of the mesopleuron and the convex anterior part of the pteropleuron; it is the only species of the genus in which the prothoracic spiracle is almost completely surrounded by bare, glossy cuticle (Fig. 81). It shares with *B. doreenae* the large glossy area on the postfrons surrounding the ocelli and the distinctive type of gland-baskets on the hind femur, but lacks other peculiarities listed for that species. The male is conspicuously different from that of *B. doreenae* and species of the *staniochi* group in having many long ventral mollisetae on the mid tibia and a massive genital capsule (epandrial complex). Also the presence of three pairs of hypandrial processes, one of which is deeply bilobed, is unique in the genus. The morphology suggests that *B. helenae* is phylogenetically somewhat isolated, but, as in the case of *B. doreenae*, I do not think that placing the species in its own monotypic group would clarify its relationships.

Borboroides helenae has most frequently been collected around wombat dung baits.

The specific epithet refers to Helen M. Smith, in recognition of her valuable help in the preparation of this paper.

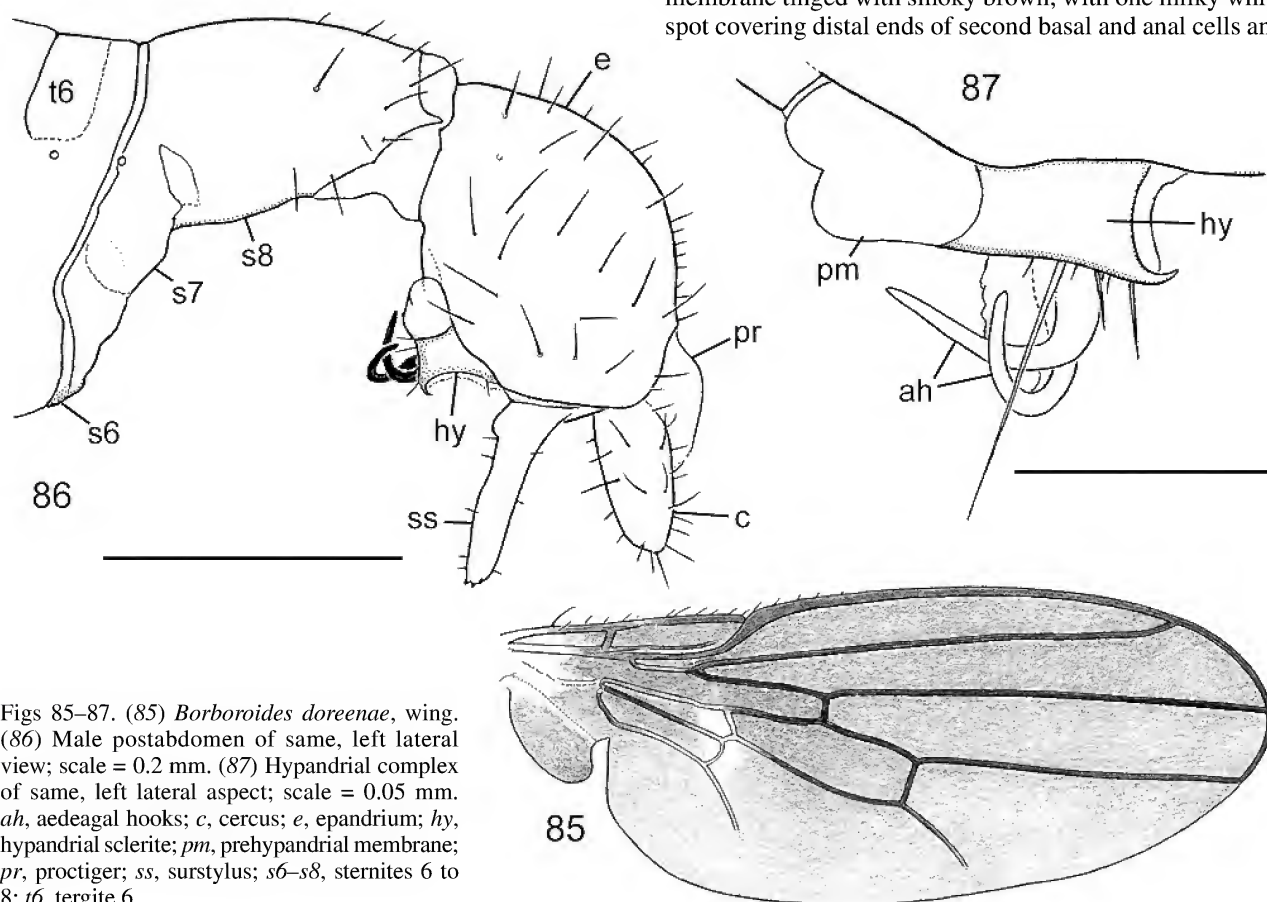
Borboroides doreenae n.sp.

Figs 1–3, 85–87

Material examined. HOLOTYPE. ♀, New South Wales: Putty Road, 41 km N of Colo River bridge, 33°11'S 150°41'E, c. 220 m [Yengo National Park], 6.vi.2002, D.K.M. (AM K219751). Mounted on card point. PARATYPES. New South Wales: 3 ♂♂, 10 ♀♀, same locality as holotype, May, June, Sept. 2002–2004, D.K.M. (AM, ANIC, USNM).

Description (male, female). Very small, largely black fly with slight but distinctive wing markings; agreeing with description given for *B. staniochi* except as indicated below.

Coloration. Postfrons largely shining to subshining black to brown-black, dark-pruinescent between and in immediate vicinity of ocelli and narrowly along orbital margins, but not in front of anterior ocellus; face densely greyish to yellowish brown-pruinescent, paler in male. Antenna orange-tawny; segment 3 dark brown on dorsal and distal parts. Palpus pale cream to yellow in male, black to dark brown in female. Mesopleuron with pruinescence almost as extensive as in *B. staniochi*, but less dense; sternopleuron glossy with small zones of pruinescence near centre and on ventral part. Fore coxa yellow; other coxae brownish yellow; femora and tibiae brownish, yellowish to variable extent basally; fore tarsus with segment 1 brown, sometimes narrowly yellowish at apex, segments 2 to 4 pale yellowish, segment 5 tawny or tawny-yellow, other tarsi yellow to tawny-yellow, with segment 5 and sometimes segment 1 tawny-brown. Wing membrane tinged with smoky brown, with one milky white spot covering distal ends of second basal and anal cells and



Figs 85–87. (85) *Borboroides doreenae*, wing. (86) Male postabdomen of same, left lateral view; scale = 0.2 mm. (87) Hypandrial complex of same, left lateral aspect; scale = 0.05 mm. *ah*, aedeagal hooks; *c*, cercus; *e*, epandrium; *hy*, hypandrial sclerite; *pm*, prehypandrial membrane; *pr*, proctiger; *ss*, surstylus; *s6*–*s8*, sternites 6 to 8; *t6*, tergite 6.

basal and anal crossveins, and another at extreme base; veins elsewhere brown. Abdominal tergites largely shining or subshining black, thinly pruinescent.

Head. Outline of eye tending slightly oval, its surface with sparse, inconspicuous ommatrichia; face slightly raised on median line, concave in profile; height of cheek 0.41–0.54 of height of eye; posterior fronto-orbital bristle strongly curved laterad; anterior fronto-orbital bristle not differentiated from adjacent setulae. Antenna: segment 3 short-ovoid, broadly rounded distally; length of arista subequal to or shorter than greatest diameter of eye. Prelabrum in female moderately developed but not prominent, separated from face by membranous band, in male very small and remote from lower margin of face; palpus short.

Thorax. Supra-alar and posterior intra-alar bristles rather small; anterior sternopleural bristle very small. Fore femur with all posteroventral bristles short, rather poorly differentiated, in male only with a regular, comb-like series of more numerous short, thickened anteroventral bristles; mid femur with anterior bristles few and irregular; hind femur with basket glands as described above; fore tibia, in male only, with two smooth, low but rather sharp longitudinal ridges, an anteroventral one occupying approximately basal third of tibia, and a slightly more prominent, more ventrally placed ridge occupying much of remainder of tibial length; mid tibia with paired preapical dorsal bristles longer than in *B. staniochi*, with the following subapical spurs in both sexes: anterior, ventral, no posterior one; hind tibia without distinct preapical dorsal bristle and apical anteroventral spur. Wing: subcosta sclerotized for 0.8 of length of second costal cell (i.e. distinctly longer than in *B. staniochi*), but weakened at humeral position; anterior crossvein meeting vein 4 slightly before mid-length of discal cell; apical section of vein 4 c. 3.2–4.3× as long as penultimate section; posterior crossvein moderately oblique to almost transverse; distal section of vein 6 extending slightly more than half distance from anal crossvein to margin.

Abdomen. Male postabdomen: sternite 5 nearly as broad as tergite 5, with each posterolateral angle strongly produced, not narrowed medially; tergite 6 sclerotized, undivided, rather small; protandrium stout, little longer than tergite 5, with anteroventral sclerotization asymmetrical, but sternite 6 forming complete, symmetrical, darkly sclerotized ventral band; sternite 8 with extensive ventral sclerotization; surstylus slender, slightly incurved, not widened distally, with few minute setulae and two to five small tooth-like spinules at apex; hypandrium with sclerotized plate on each side, each plate with few setulae of very diverse sizes, and a sharp, curved posterolateral point (but otherwise no indication of hypandrial process or gonite), and compact lateral extension touching margin of epandrium; aedeagus short, compact, largely membranous, but flanked by pair of large, black, sclerotized hooks, their apices extending well beyond membranous part; aedeagal apodeme rather stout, of moderate length, directed towards dorsal wall of epandrium; cerci rather long, ovoid, obtuse, extensively irregularly setulose, joined by membrane for more than half their length, but without sclerotized connecting bar. Female postabdomen: cercus shorter and broader than in *B. staniochi*.

Dimensions. Total length, ♂ 1.4–1.9 mm, ♀ 1.5–2.2 mm; length of thorax, ♂ 0.67–0.85 mm, ♀ 0.66–0.96 mm; length of wing, ♂ 1.6–1.9 mm, ♀ 1.5–2.3 mm.

Distribution. New South Wales: lowlands of Colo River district, between Blue Mountains and Hunter Valley. Only known from the type locality.

Notes

Borboroides doreenae has the general superficial characters of the *staniochi* and *helenae* groups, particularly in the venation and the reduction of the anterior fronto-orbital bristle. It is readily distinguished from other species of these groups by the absence of distinct posteroventral bristles on the fore femur, the bicoloured fore tarsus, and the milky white spot covering the distal ends of the second basal and anal cells. In the male, the hypandrial structure is unique in the genus, as it lacks any well defined paired processes, and no other *Borboroides* species has an even remotely similar aedeagus. Because of limited available material, I have not been able to illustrate male postabdominal structures in the detail desired. I justify inclusion of this species in the same group as *B. helenae* mainly by the similarity in the hind femoral gland-baskets and glossy zones on the postfrons and lower propleuron, despite the divergence in some other significant characters.

All specimens were taken around wombat dung baits.

Parva group

Diagnostic description. Fronto-orbital bristles two, anterior one c. as long as posterior one, directed outwards, posterior one more definitely reclinate than in other groups, only slightly inclined outwards (Fig. 88); antennal segment 3 short but slightly longer than deep, generally almost porrect; mesoscutum with numerous setulae; dorsocentral bristles one pair only; postalar bristle located medially from apex of postalar callus (Fig. 89); mesopleuron with several setulae; mid tibia without anterior bristle before level of preapical dorsal pair, with large ventral and small anterior subapical spurs, no distinct posterior one; length of discal cell along vein 5 less than 3× distance of its posterior angle from margin, latter measured in direction of distal section of vein 5; section of vein 5 on discal cell strongly curved; anal crossvein and section of vein 6 beyond anal cell absent; abdominal sternite 1 divided by median desclerotization.

Included species. *Borboroides parva* n.sp.

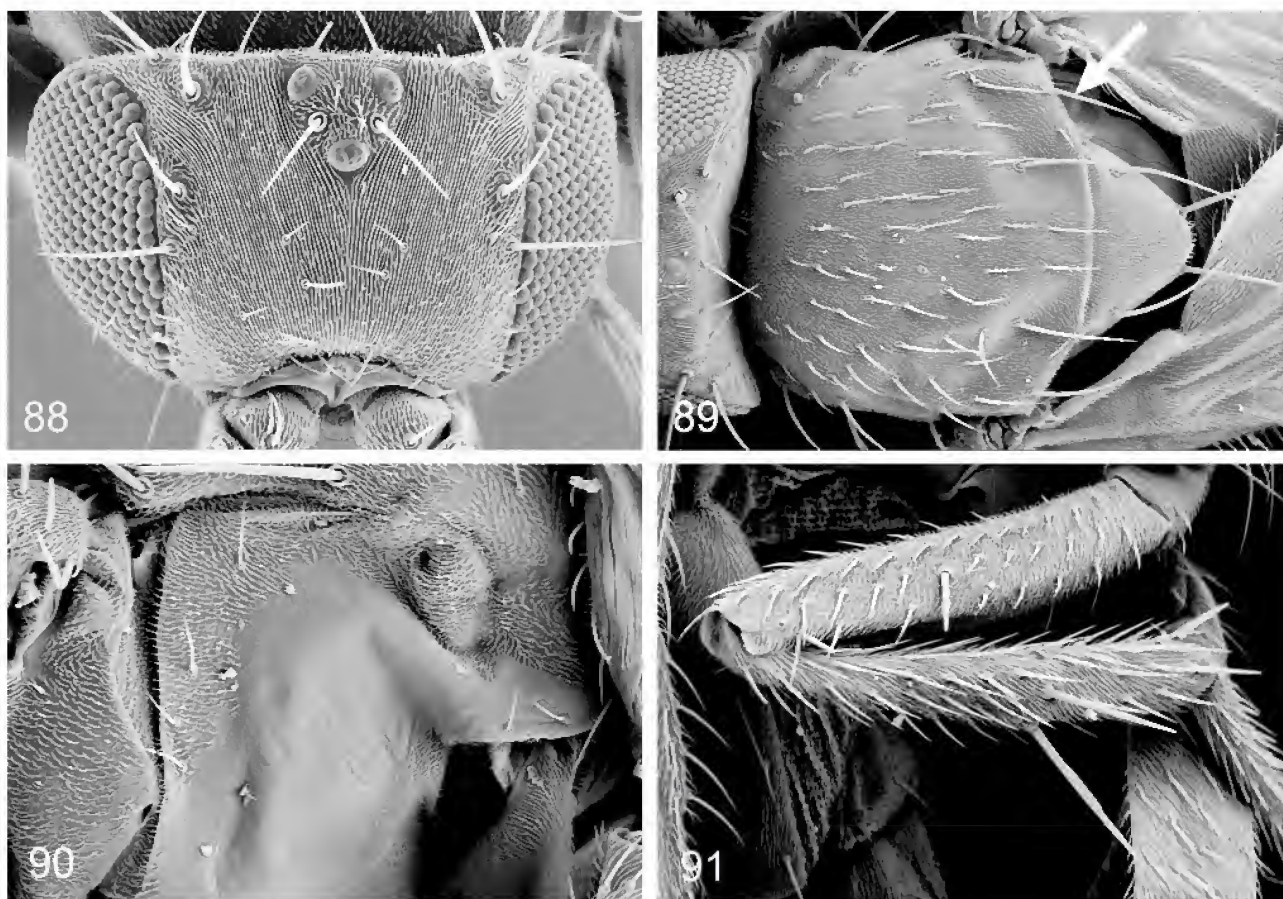
Borboroides parva n.sp.

Figs 13, 14, 88–96

Material examined. HOLOTYPE. ♂, New South Wales: Putty Road, 41 km N of Colo River bridge, 33°11'S 150°41'E, c. 220 m [Yengo National Park], 31.v.2002, D.K.M. (AM K219752). Mounted on card point. PARATYPES. New South Wales: 139♂♂, 32♀♀, same locality as holotype, May, June, Sept. 2002–2004, D.K.M. (AM, ANIC, BM, BPB, CNC, MNHG, USNM); 22♂♂, 16♀♀, Putty Road at Tinda Creek, 33°10'S 150°42'E, 31.v.2002, D.K.M. (AM, AMST).

Description (male, female). Minute, blackish, stout sphaerocerine-like fly.

Coloration. Head, thorax, legs and abdomen almost



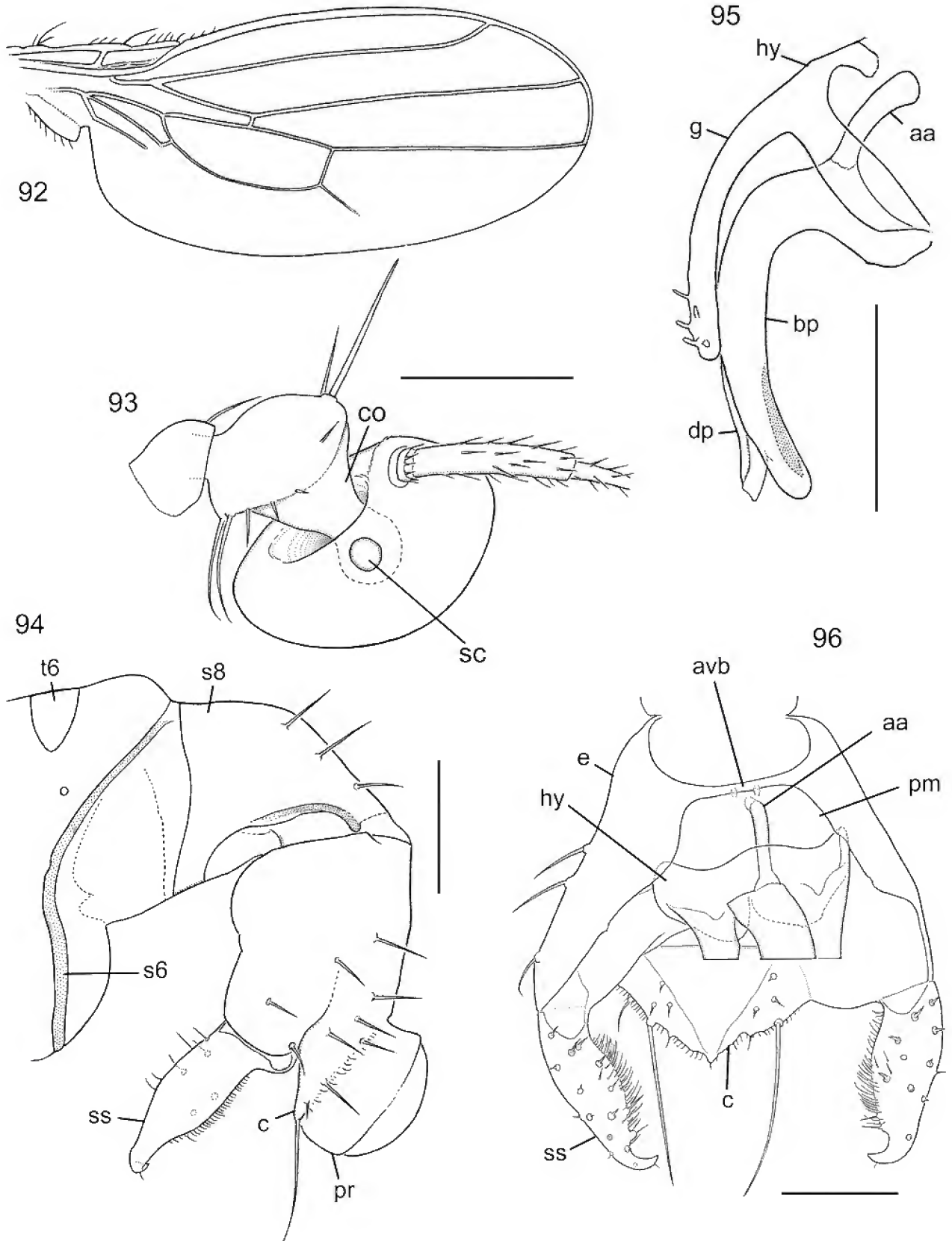
Figs 88–91. (88) *Borboroides parva*, head. (89) Dorsal view of thorax of same, postalar bristle indicated. (90) Right propleural and mesopleural region of thorax of same. (91) Part of right mid leg of male of same, anterior view.

uniformly black to very dark brown. Postfrons entirely dull-pruinose, usually with yellowish brown suffusion anteriorly; lower margin of cheek grey-pruinose. Antenna blackish. Palpus dark grey-brown. Mesoscutum and scutellum grey-pruinose; mesopleuron shining blackish centrally and anteroventrally, extensively grey-pruinose anterodorsally and posterodorsally; sternopleuron largely subshining, with little pruinoscence; pteropleuron and pleurotergite relatively densely grey-pruinose. Legs almost uniformly dark brown; fore coxa tending to yellowish brown. Wing without markings; membrane tinged with smoky brown. Halter with yellowish brown pedicel and darker greyish brown capitellum. Abdominal tergites extensively grey- to brown-pruinose.

Head higher than long; eye subcircular, with moderately sparse but obvious ommatrichia; postfrons broad and convex, with few, mostly erect anterior setulae; face slightly concave in profile, but with upper median part elevated, i.e. more distinctly carinate than in *B. atra* etc.; height of cheek 0.33–0.44 of height of eye; postvertical bristle moderately developed, smaller than in *B. atra*; ocellar bristle large, but not potentially reaching ptilinal suture; posterior fronto-orbital bristle reclinate and slightly sloped outwards; anterior fronto-orbital about as long as or slightly longer than posterior one, strongly directed outwards. Antenna more markedly pectinate than in *B. fimbria*, *B. atra* etc.; segment 3 almost hemispherical, with doughnut-shaped proximal surface containing large central cavity, with both arisal insertion and sacculus remarkably close to basal rim;

arista c. 1.6–2.0× as long as maximum diameter of eye, with numerous hairs/pubescence on whole length, those on distal half slightly longer than diameter of segment 5, those on basal part shorter. Prelabrum well sclerotized but not prominent, slightly but significantly larger in female than in male; palpus stout and moderately short; proboscis moderately small, but labella not particularly reduced.

Thorax stout; intradorsocentral setulae in four rows (two pairs) anteriorly and centrally; usually a pair of prescutellar acrostichal setulae scarcely larger than other setulae; scutellum without setulae; mesopleuron with few coarse posterior setulae; pteropleuron without setulae; the following thoracic bristles present: humeral, presutural, 1+1 notopleurals, postalar (displaced, mesad of postalar callus), 0+1 dorsocentrals; supra-alar and additional postsutural dorsocentral sometimes weakly differentiated; posterior intra-alar represented only by small setula; two unequal pairs of scutellars; one sternopleural. Fore femur with two to four posteroventral bristles and mostly shorter posterodorsal bristles; mid femur with one differentiated anterior bristle slightly beyond mid length; hind femur without differentiated bristles; fore and hind tibiae with some rather long setulae but no differentiated bristles or spurs; mid tibia with two large preapical dorsal bristles at slightly different levels, long apical ventral spur, and smaller apical anterior spur, otherwise without anterior bristles. Wing: costa with one well differentiated anterodorsal bristle just before humeral break (rarely duplicated or located just beyond humeral break); subcosta weakened opposite humeral break of costa,



Figs 92–96. (92) *Borboroides parva*, wing. (93) Right antenna of same; scale = 0.05 mm. (94) Male postabdomen of same, left lateral view; scale = 0.05 mm. (95) Hyandrial structures and aedeagus of same, left lateral view; scale = 0.05 mm. (96) Epandrial and hyandrial structures of same, anteroventral view, gonites and aedeagus cut short; scale = 0.05 mm. *aa*, aedeagal apodeme; *avb*, anteroventral bridge of epandrium; *bp*, basiphallus; *c*, cercus; *co*, conus; *dp*, distiphallus; *e*, epandrium; *g*, gonite; *hy*, hyandrial sclerite; *pm*, prehyandrial membrane; *pr*, proctiger; *sc*, sacculus; *ss*, surstylus; *s6*, *s8*, sternites 6 and 8; *t6*, tergite 6.

but sclerotized for short distance beyond break; anterior crossvein meeting vein 4 near or slightly basad of mid-length of discal cell; apical section of vein 4 c. 2.4–2.9× as long as penultimate section; basal crossvein oblique and aligned with strongly curved section of vein 5 bordering discal cell; apical section of vein 5 straight or almost so; anal crossvein and apical section of vein 6 absent.

Abdomen. Sternite 1 very short, sclerotized only at sides; tergite 5 slightly shorter than tergite 4 (both sexes). Male postabdomen: tergite 6 rather small, undivided; each spiracle 6 in membrane below lateral margin of tergite; spiracle 7 apparently absent; protandrial region posteriorly attenuated to form very short hypopygial petiole; sternite 6 reduced to long, darkly sclerotized strip on left side only, dorsally connected to sternite 8; sternite 7 distinct on left side, extending round ventral surface, weakly sclerotized; sternite 8 well sclerotized dorsally with two or three pairs of bristles or large setulae and no or few smaller setulae, with sclerotized ventral bridge anteriorly, and behind this with submarginal heavily sclerotized strip on each side terminating on posterior condyle; epandrium more elongate than in *Heleomicra* but less so than in other *Borboroides* spp., with several stout setulae, and anteroventral bridge sclerotized but much attenuated; prehypandrial membrane smooth and glassy, without microtrichia; surstylus moderately elongate, articulated basally, with numerous microtrichia and few larger setulae on inner surface, with few microtrichia only on outer surface; hypandrium sclerotized anteriorly in front of aedeagal base, with lateral extension on each side articulating with epandrium but bearing no setulae; gonite long, curved, its apex posteriorly directed, with few small, mostly blunt setulae distally; basiphallus elongate, curved, with apex posteriorly directed; distiphallus small, membranous, largely recessed in subapical part of basiphallus; phallopodeme short, broadly bilaterally compressed, with no sclerotized connection to hypandrium; cerci joined by membranous proctiger for their full length, lacking ventral connecting sclerotized bar at bases and definite articulation with epandrium, each with fine microtrichia, few setulae, and one very long terminal bristle. Female postabdomen simple, tapered on c. posterior half; cerci somewhat elongate, free, with fine setulae of various lengths.

Dimensions. Total length, ♂ 0.76–1.2 mm, ♀ 1.0–1.3 mm; length of thorax, ♂ 0.33–0.50 mm, ♀ 0.42–0.52 mm; length of wing, ♂ 0.94–1.4 mm, ♀ 1.2–1.5 mm.

Distribution. New South Wales: lowlands of Colo River district, between Blue Mountains and Hunter Valley. The known distribution is very restricted, including only two spot localities c. 3 km apart. This may change with wider use of the collection technique.

Notes

Borboroides parva shares some features with species of the *atra* group, notably the long, outwardly directed anterior fronto-orbital bristle, the presence of only one dorsocentral bristle, and the strongly bowed section of vein 5 bordering the discal cell; the dull, dark coloration and the distribution of pruinescence on the head and thorax are similar conditions to those of *B. shippi* of that group. It differs from the *atra* group in the longer arista and divided abdominal sternite 1, but the large costal bristle near the humeral break, the distally open

anal cell, the single anterior bristle on the mid femur, the absence of any non-terminal anterior bristle on the mid-tibia, the relatively short protandrium, the continuous sclerotization of the hypandrial plate in front of the aedeagal base, and the unusual structure of the aedeagus are unique in the genus. Some of these conditions would have been considered to represent generic characters in pre-Hennigian taxonomy, but careful consideration suggests that the species is probably phylogenetically nested among the taxa of *Borboroides*, particularly those with the distinctive few dorsally directed mesopleural setulae and curved penultimate section of vein 5 (*staniochi*, *helenae*, and *atra* groups). Its unique character states are interpreted as probable autapomorphies.

Borboroides parva is, on the average, the smallest insect in the genus, but there is size overlap with some species of the *atra* group.

All material was collected around wombat dung bait in an area with numerous wombat burrows.

The specific epithet is a Latin adjective—small.

Atra group

Diagnostic description. Fronto-orbital bristles two, anterior bristle as long or nearly as long as posterior one, directed outwards; antennal segment 3 short, rounded, generally somewhat decumbent; mesoscutum with numerous setulae; dorsocentral bristles usually one (posterior) pair only, or sometimes one or two more anterior ones, but none in front of transverse suture; mesopleuron with several setulae; mid tibia in both sexes with one anterior bristle slightly basad of level of preapical dorsal pair, and two well-developed subapical spurs, one anterior, one ventral (no posterior one); length of discal cell along vein 5 much less than 3× distance of its posterodistal angle from margin, latter measured in direction of distal section of vein 5; section of vein 5 on discal cell curved for most of length; distal section of vein 6 sclerotized, not over twice as long as well sclerotized anal crossvein; abdominal sternite 1 well sclerotized and undivided.

Included species. *Borboroides menura* n.sp., *B. gorodkovi* n.sp., *B. shippi* n.sp., *B. corynetes* n.sp., *B. petiolus* n.sp., *B. fimbria* n.sp., *B. bulberti* n.sp., *B. merzi* n.sp., *B. acumen* n.sp., *B. atra* Malloch, *B. woodhilli* n.sp.

Borboroides menura n.sp.

Figs 7, 8, 97–101

Material examined. HOLOTYPE. ♂, New South Wales: Kanangra-Boyd National Park, 1 km N of Boyd River [or Morong Creek] bridge, 1200 m, 22.ix.2005, D.K.M. (AM K219753). Near dead chook. Mounted on card point. PARATYPES. New South Wales: 9♂♂, 2♀♀, same data as holotype, but some Oct. 2005 (AM, USNM). Australian Capital Territory: 1♂, Picadilly Circus [Brindabella Range, 35°22'S 148°49'E], 800 m, April 1978, S.B.P., J.K.-P. (ANIC).

Description (male, female). Small, slightly elongate, largely black fly, slightly larger than other species of *atra* group.

Coloration. Head largely black; face, anterior part of cheek, and anterior part of postfrons yellow in male, tawny-brown in female; postfrons pruinescent on rather more than

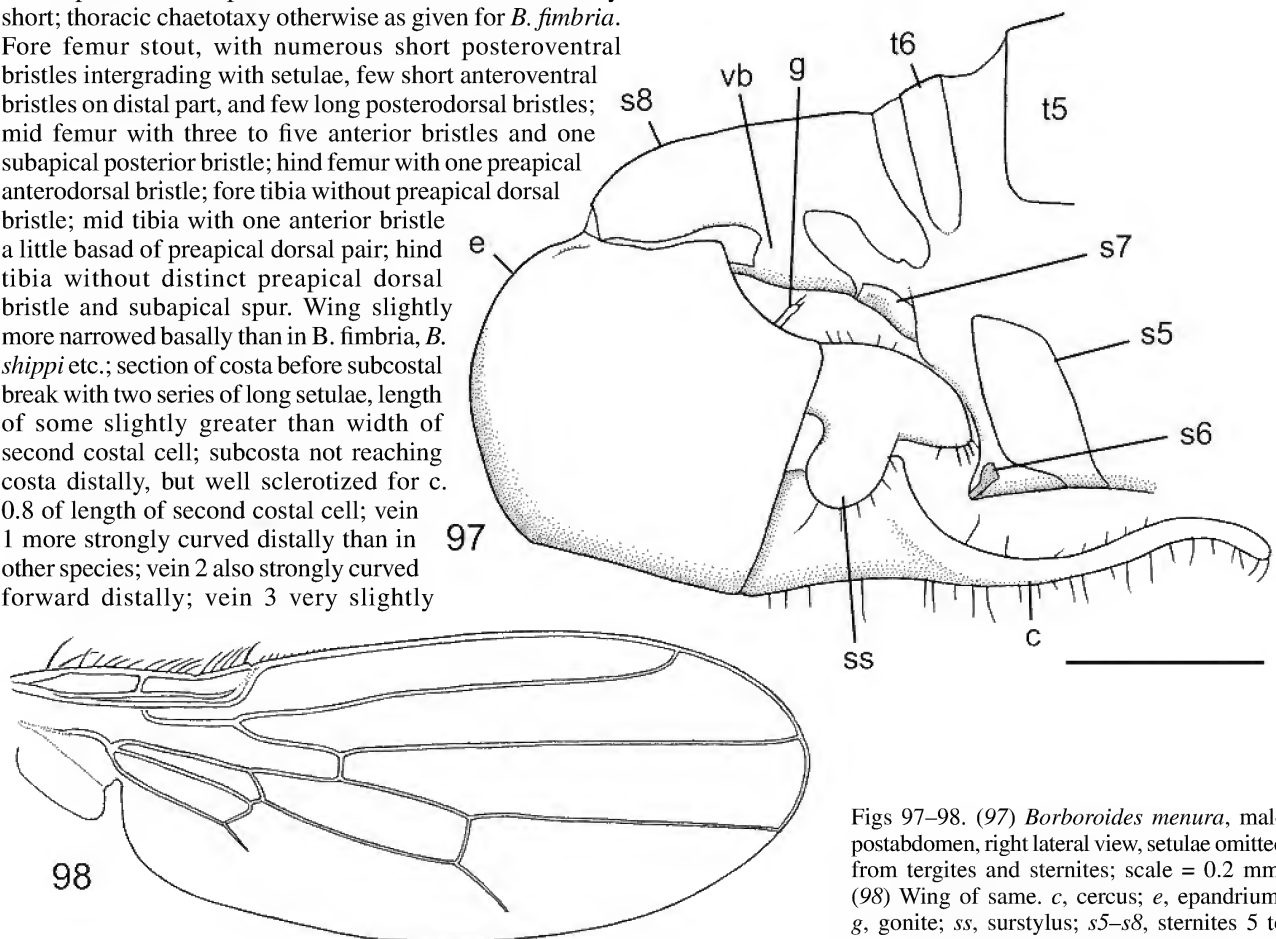
anterior half, with large bare, shining to subshining zone on each side of ocelli and quite small subtriangular glossy zone in front of anterior ocellus. Antenna tawny-yellow, with arista and dorsal suffusion on segment 3 brown. Prelabrum brown in male, black in female; palpus yellowish brown to dark brown. Thorax normally black (fading to brown in old specimens); mesoscutum and scutellum evenly pruinose; mesopleuron pruinose on c. posterior half and on dorsal margin; sternopleuron pruinose on dorsal margin; hypopleuron pruinose both anteriorly and posteriorly. Legs largely blackish brown; fore coxa partly tawny-brown. Wing unmarked. Halter tawny, with pale yellow capitellum. Abdominal tergites black with brown pruinoscence; tergite 5 of female shining, with generally distributed sparse pruinoscence.

Head. Eye c. as long as high or slightly longer; postfrons with numerous short setulae anteriorly; height of cheek c. 0.33–0.47 of height of eye; ocellar bristle slightly longer than posterior fronto-orbital bristle; anterior fronto-orbital bristle c. as long as posterior one, directed outwards. Antenna: segment 3 slightly longer than deep; arista c. as long as greatest diameter of eye. Prelabrum small and shallow in male, larger and more prominent in female; palpus moderately short.

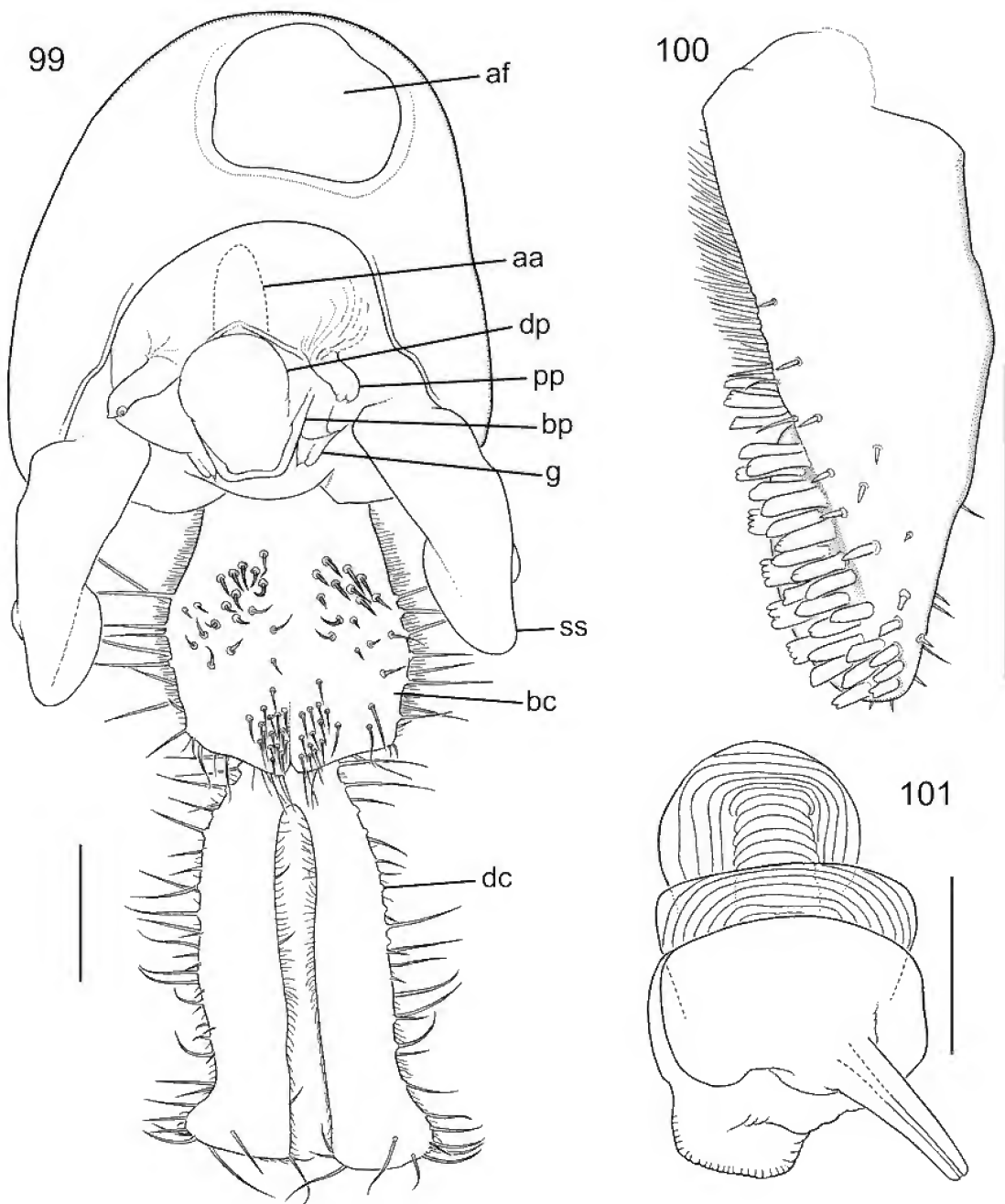
Thorax. Mesoscutum with intradorsocentral setulae on anterior half in two pairs of rows, with few in outer row; mesopleuron with c. four setulae on or near posterior margin; dorsocentral bristles two, length of anterior one c. 0.8 of that of posterior one; posterior intra-alar bristle moderately short; thoracic chaetotaxy otherwise as given for *B. fimbria*. Fore femur stout, with numerous short posteroventral bristles intergrading with setulae, few short anteroventral bristles on distal part, and few long posterodorsal bristles; mid femur with three to five anterior bristles and one subapical posterior bristle; hind femur with one preapical anterodorsal bristle; fore tibia without preapical dorsal bristle; mid tibia with one anterior bristle a little basad of preapical dorsal pair; hind tibia without distinct preapical dorsal bristle and subapical spur. Wing slightly more narrowed basally than in *B. fimbria*, *B. shippi* etc.; section of costa before subcostal break with two series of long setulae, length of some slightly greater than width of second costal cell; subcosta not reaching costa distally, but well sclerotized for c. 0.8 of length of second costal cell; vein 1 more strongly curved distally than in other species; vein 2 also strongly curved forward distally; vein 3 very slightly

curved, slightly diverging from vein 4 apically; apical section of vein 4 2.1–2.3 times as long as penultimate section; anterior crossvein meeting vein 4 well before mid-length of discal cell; basal crossvein oblique; anal crossvein oblique, almost straight, but curved at anterior end; distal section of vein 6 as long as anal crossvein or somewhat longer.

Abdomen. Sternite 1 well sclerotized and undivided. Male: tergite 5 nearly as large as tergite 4; sternites 4 and 5 short, very broad, medially attenuated. Male postabdomen: tergite 6 narrowly transverse, undivided; compound protandrial sclerite rather short for *atra* group, anteriorly strongly asymmetrical, with sternite 6 extensively developed on left side and part of ventral surface, but not on right side; sternite 7 sclerotized; sternite 8 bridged ventrally, with bridge contracted on right side; epandrium, including its anteroventral bridge, asymmetrical (Fig. 99); surstylus with two lobes, one directed distally, one directed posteriorly, both lobes with few setulae, distal lobe, in addition, heavily spinulose on inner surface, some of larger spinules distally compressed and bearing two to four rounded apical teeth; basal section of surstylus densely pubescent on inner surface; prehypandrial membrane rugose, without microtrichia; hypandrium with pair of narrowly bifid posteriorly directed lobes; a pair of prominent elongate processes arising from prehypandrial membrane where it borders on hypandrium, each minutely bifid and bearing two fine hair-like apical projections; basiphallus very short, sclerotized at least on posterior surface; distiphallus more elongate, consisting



Figs 97–98. (97) *Borboroides menura*, male postabdomen, right lateral view, setulae omitted from tergites and sternites; scale = 0.2 mm. (98) Wing of same. c, cercus; e, epandrium; g, gonite; ss, surstylus; s5–s8, sternites 5 to 8; t5, t6, tergites 5 and 6; vb, ventral bridge of sternite 8.



Figs 99–101. (99) *Borboroides menura*, epandrial and some hypandrial structures, anteroventral view, distiphallus and macrotrichia of epandrium and surstyli omitted; scale = 0.1 mm. (100) Left surstylus of same, anterior view; scale = 0.1 mm. (101) Distiphallus of same, anterodistal view; scale = 0.05 mm. *aa*, aedeagal apodeme (seen through prehypandrial membrane); *af*, anterior foramen of epandrium; *bc*, fused basal body of cerci; *bp*, basiphallus; *dc*, free distal lobe of cercus; *dp*, distiphallus; *g*, gonite; *pp*, prehypandrial process; *ss*, surstylus.

of three main irregularly bulbous sections, not strongly sclerotized but its basal and mid sections with many subparallel denticulate sclerotized ridges; distal section of aedeagus largely smooth, transparent, bearing beak-like terminal process with apical gonopore; cerci basally articulated with epandrium, their bases fused to form a stout body bearing a diversity of setulae and, on its posterodistal surface, a large process, forked from just beyond its base to form pair of very long, compressed, distally slightly spatulate lobes, which remain exposed when genital complex

is infolded. Female postabdomen: segments 6 and 7 not attenuated, with undivided tergites and sternites; cercus not clavate.

Dimensions. Total length, ♂ 1.7–2.1 mm, ♀ 2.1–2.3 mm; length of thorax, ♂ 0.74–0.87 mm, ♀ 0.83–0.95 mm; length of wing, ♂ 2.3–2.5 mm, ♀ 2.7–2.8 mm.

Distribution. New South Wales: highlands—few records. Australian Capital Territory: only known from highlands near Canberra.

Notes

Borboroides menura agrees with most species of the *atra* group in the long, outwardly directed anterior fronto-orbital bristle, the distribution of pruinescence on the mesopleuron and hypopleuron, the setulose mesopleuron, the short distal section of vein 6, and the well sclerotized undivided abdominal sternite 1. Within this group it is distinguished by its slightly larger size, quite large additional dorsocentral bristle near mid-length of mesoscutum, the different gland complexes on the hind femur, the strong distal curvature of vein 1, the more elongate anal and discal cells so that the discal crossvein is located well beyond mid-length of wing, and, in the male, the development of sternite 6 on the left side only and the much larger, strangely shaped cercus. These conditions for sternite 6 and the femoral gland complexes and the proportions of the anal and discal cells are probably more plesiomorphic than in all other species of the *atra* group. *Borboroides menura* therefore appears to be a phylogenetically basal taxon within this group. The more oblique anal crossvein is probably also plesiomorphic for the group, but the condition is approached in *B. gorodkovi*, which, with a little variation, has venation intermediate between that of *B. menura* and other species of the *atra* group. Absence of the usual very short microtrichia on the prehypandrial membrane of the male is a probable autapomorphy for *B. menura*, though it is repeated in *B. parva*, which appears not to be closely related.

The specimen from Picadilly Circus is labelled “carrion trap.” The other specimens were collected on or near old carcasses of domestic fowl.

The specific epithet (Greek, mighty tail) is the generic name of the lyre-bird, in reference to the similarity of the male cercal lobes to the major male tail feathers of that sympatric Australian bird.

Borboroides gorodkovi n.sp.

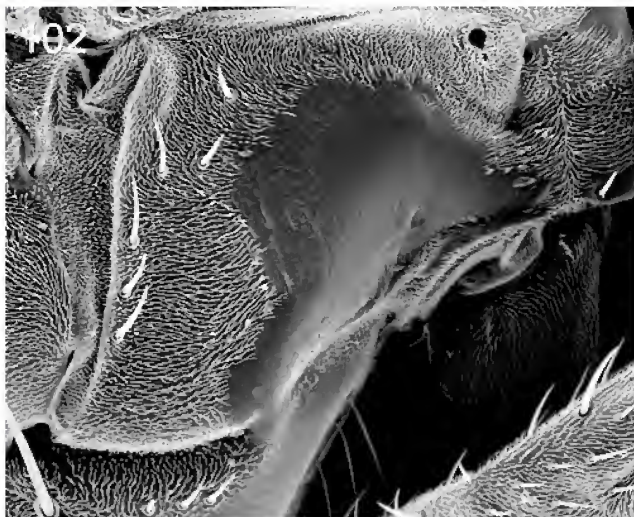
Figs 9, 10, 102–107

Material examined. HOLOTYPE. ♂, Tasmania: The Neck, Bruny Island [“Penguin Rookery” on some maps, c. 43°17'S 147°21'E], 16–18.iii.2005, B.J.D., D.K.M. (AM K219754). Mounted on card point. PARATYPES. Tasmania: 26 ♂♂, 18 ♀♀, similar data to holotype, but some collected Dec.1987, D.K.M. (AM, ANIC, USNM, TDPI).

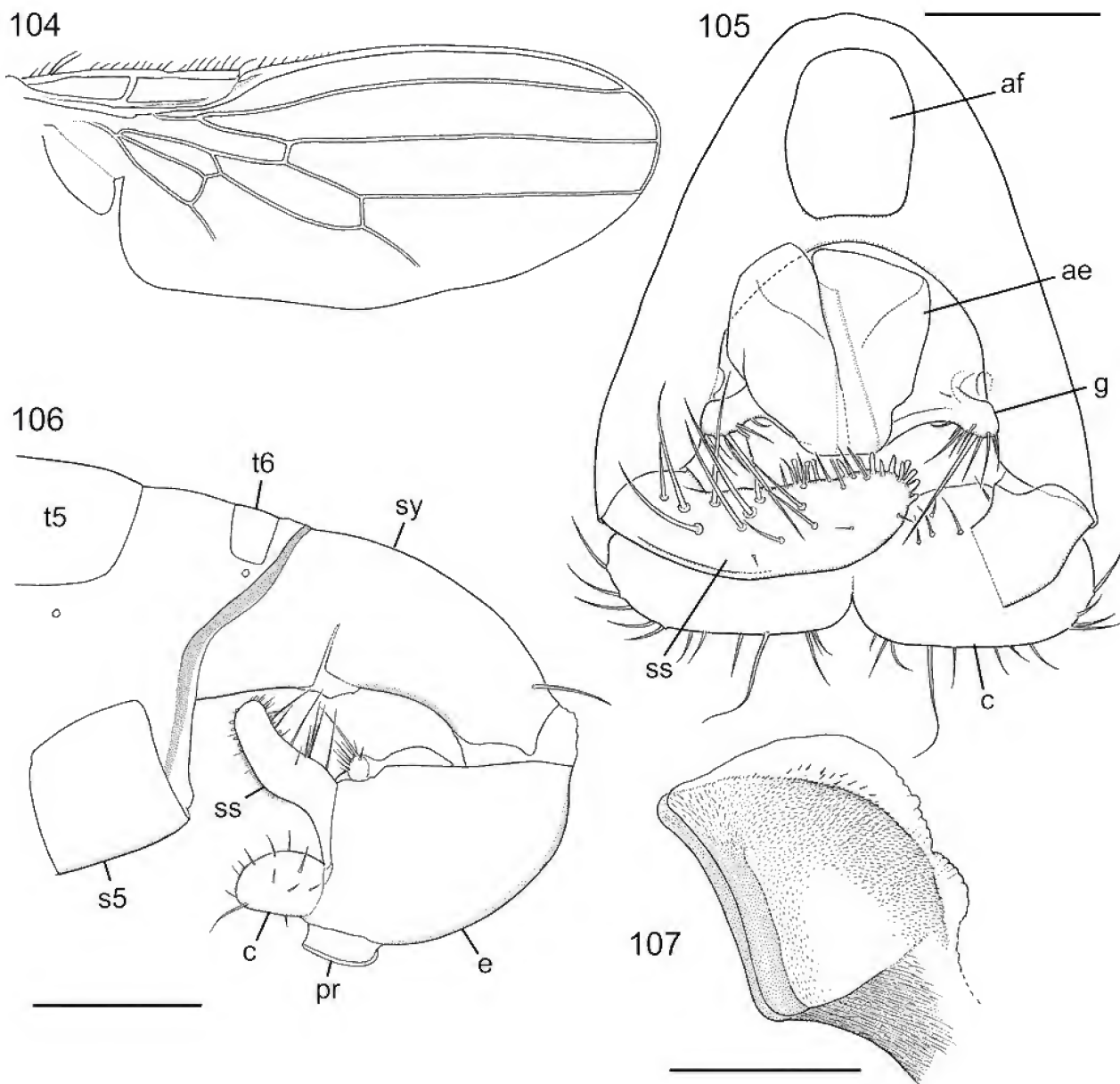
Other material. New South Wales: 1 ♀, Goonoo State Forest, 5 mi. [c. 8 km] S of Mendooran, May 1970, D.K.M., G.A.H., G.D. (AM). South Australia: 1 ♀, Pine Dams on Myrtle Springs Station, 24 mi. [c. 39 km] WNW of Leigh Creek, June 1964, R.O.C. (AM). Western Australia: 1 ♂, Stirling National Park, “54-mile post” [Stirling Ranges], Oct. 1970, D.H.C. (ANIC); 2 ♀♀, 28 km W of Yalgoo, Sept. 1981, G.A.H. (AM).

Description (male, female). Small grey-black fly, somewhat resembling *B. shippi*.

Coloration. Predominant ground-colour black. Occiput and c. posterior half of postfrons black with dense dark grey pruinescence; c. anterior half of postfrons typically yellowish-tawny, entirely pruinose; face greyish tawny; cheek typically extensively yellow to tawny-yellow, becoming blackish posteriorly, with yellowish-pruinose zone along lower margin. Antenna: segments 1 and 2 tawny-brown; segment 3 typically bicoloured, tawny-yellow and brown. Prelabrum blackish with grey pruinescence; palpus typically yellow or tawny-yellow. Thorax with dense dark grey pruinescence on most of surface; mesopleuron with large shining to subshining black zone on central and anteroventral part, broadly grey-pruinose on posterior and dorsal margins, narrowly but distinctly grey-pruinose on margin of fore-coxal foramen; sternopleuron with subshining central zone; hypopleuron shining brown-black, except for grey pruinescence near anterior margin and on small posterodorsal zone, but posterior half otherwise bare, glossy. Fore coxa tawny; other coxae brownish; femora blackish, with dense grey pruinescence and, at each extremity, a small yellowish zone; tibiae grey-brown, yellowish apically and



Figs 102–103. (102) *Borboroides gorodkovi*, propleural and mesopleural parts of thorax, right lateral view. (103) Apical part of hind tibia of same, anterior view; subapical spur indicated.



Figs 104–107. (104) *Borboroides gorodkovi*, wing. (105) Epandrium and associated parts of same, anteroventral view, setulae on epandrium omitted, left surstylus cut away; scale = 0.1 mm. (106) Male postabdomen of same, left lateral view, setulae on tergite 5, sternites, and epandrium omitted; scale = 0.2 mm. (107) Aedeagus of same, left lateral view. *ae*, aedeagus; *af*, anterior foramen of epandrium; *c*, cercus; *e*, epandrium; *g*, gonite; *pr*, proctiger; *ss*, surstylus; *sy*, protandrial synsternite; *s5*, sternite 5; *t5*, *t6*, tergites 5 and 6.

more broadly so basally; tarsi tawny-yellow, becoming dark grey distally. Wing membrane tinged with yellowish brown; veins yellowish, becoming slightly darker apically. Halter with tawny base and pale yellow capitellum. Abdomen black; preabdominal tergites and sternites very largely grey-brown pruinose, but sternite 1 extensively shining and, in female, tergites 5 and 6 each with lateral subshining black zone.

Head much higher than long; eye subcircular or, in profile, slightly higher than long; postfrons with rather long setulae on anterior half mostly inclined forwards and mesad, those along orbits mostly reclinate; height of cheek 0.44–0.58 of height of eye; ocellar and both fronto-orbital bristles almost equally long, the two latter directed outwards, the anterior one more strongly so. Antenna rather short; segment 3 rounded, slightly decumbent, very slightly longer than

deep; arista distinctly shorter than greatest diameter of eye. Prelabrum in female broad, of moderate depth, in male narrower, more removed from lower margin of face; palpus moderately short and slender.

Thorax stout; intradorsal setulae coarse, in c. six irregular rows; mesopleuron with several coarse posterior setulae; dorsocentral bristles well developed, three pairs present; prescutellar acrostichal and posterior intra-alar bristles well developed. Fore femur with several long posterodorsal and posteroventral bristles, mainly on distal half, without anteroventral bristles; mid femur with a series of few rather short anterior bristles; hind femur usually with one preapical dorsal bristle; fore tibia often with one or two small preapical dorsal bristles; mid tibia with large bristles as described for *B. fimbria*, subapical ventral spur long and stout; hind

tibia with large preapical dorsal bristle and slender, curved subapical spur c. 1.5× as long as greatest diameter of tibia. Wing generally typical of the *atra* group (as described for *B. fimbria*); within second costal cell, subcosta sclerotized for at least 0.7 of length of that cell; apical section of vein 4 c. 2.6–3.4× as long as penultimate section; penultimate section of vein 5 less strongly curved than in other species of *atra* group so that discal cell is narrower; anal cell with posterodistal angle not acute; distal section of vein 6 slightly less than twice as long as anal crossvein.

Abdomen. Sternite 1 broader than in most other species of *atra* group, well sclerotized and not narrowed medially; in male sternites 2 to 5 all very broad, so that pleural membrane is more restricted than in other species of *atra* group; in female these sternites less broad, as in related species. Male postabdomen: tergite 6 small, fully sclerotized; spiracle 6 present in pleural membrane; spiracle 7 apparently absent; compound protandrial sclerite relatively stout, curved, tapered posteriorly, almost symmetrical; sternite 6 forming dark sclerotized band right round ventral surface, with pair of elongate anterior lobes on ventral part; sternite 8 extensively sclerotized ventrally, with pair of prominent posterior condyles, setulose, with usually one pair of enlarged posterolateral setulae; epandrium broad, with relatively narrow anteroventral bridge, numerous large, stout setulae laterally, and smaller setulae posterodorsally; surstylus stoutly rod-like, incurved, with numerous large and small anterior setulae, with small fine-tipped and truncated setulae on inner surface just beyond mid-length, and numerous stout, spinescent, mostly blunt setulae on inner surface near apex; process of lateral hypandrial sclerite slightly compressed, knob-like, with group of mainly posterior setulae, one much larger than others; aedeagus stout; basiphallus with dark sclerite covering at least posterior surface; distiphallus broadly bilobed beyond epandrial bridge; cercus very broad, with distal margin transverse (the pair together approximately as wide as epandrium), with moderately short setulae and one longer posterior setula. Female postabdomen: cercus elongate, not thickened distally.

Dimensions. Total length, ♂ 1.4–1.9 mm, ♀ 1.8–2.0 mm; length of thorax, ♂ 0.67–0.88 mm, ♀ 0.88–1.0 mm; length of wing, ♂ 1.6–1.9 mm, ♀ 1.7–2.0 mm.

Distribution. New South Wales: Central West division. Tasmania: Bruny Island. South Australia: Flinders Ranges. Western Australia: Stirling Ranges; Central West division.

Notes

Borboroides gorodkovi is fairly typical of the *atra* group and particularly resembles those species with more extensively pruinose mesopleuron and no glossy zone in front of the anterior ocellus (e.g., *B. shippi* and *B. corynetes*). It differs from these in the presence of three pairs of dorsocentral bristles (usually one or two pairs in the other species), the longer subapical spur of the hind tibia, the less curved section of vein 5 bordering the discal cell, the well marked but narrow zone of dense pruinoscence along the margin of the fore coxal foramen, the largely glossy posterior section of the hypopleuron, and particularly the details of the surstylus and cercus of the male.

More than any other species of the *atra* group, *B. gorodkovi* resembles *B. dayi* and *B. staniochi*, which may

conceivably constitute a close outgroup to the *atra* group, but these two species have the anterior fronto-orbital bristle reduced, the subapical spur of the hind tibia short or vestigial, vein 6 longer, and the hind femur without gland-baskets. It is possible that *B. gorodkovi* represents a sub-basal branch of the *atra* group, arising after the separation of *B. menura*.

Part of the evidence that Australian mainland populations are conspecific with the Tasmanian type population is the similarity of the male genitalia of the specimen from Stirling National Park (Western Australia) to those of the Tasmanian specimens. However, this male specimen differs strongly from all the Tasmanian specimens in having no yellow zone on the postfrons, the cheek entirely blackish in ground colour, and the palpus dark brown. Males are not available from other mainland localities. The females from Myrtle Springs (South Australia) and Yalgoo district (Western Australia) resemble the type population in coloration, while that from Goonoo State Forest (New South Wales) is intermediate (probably faded—collected May 1970). Until better material is available, I cannot be certain that all specimens from mainland localities are referable to *B. gorodkovi*.

The habitat on Bruny Island is on dunes densely penetrated by burrows of penguins (*Eudyptula minor*) and shearwaters (*Puffinus* sp.). A short distance from this “rookery” in forest on sand, *Borboroides gorodkovi* could not be found, though *B. fimbria* and *B. atra* were present. The specimen from Goonoo State Forest was collected from an old, drying kangaroo carcass.

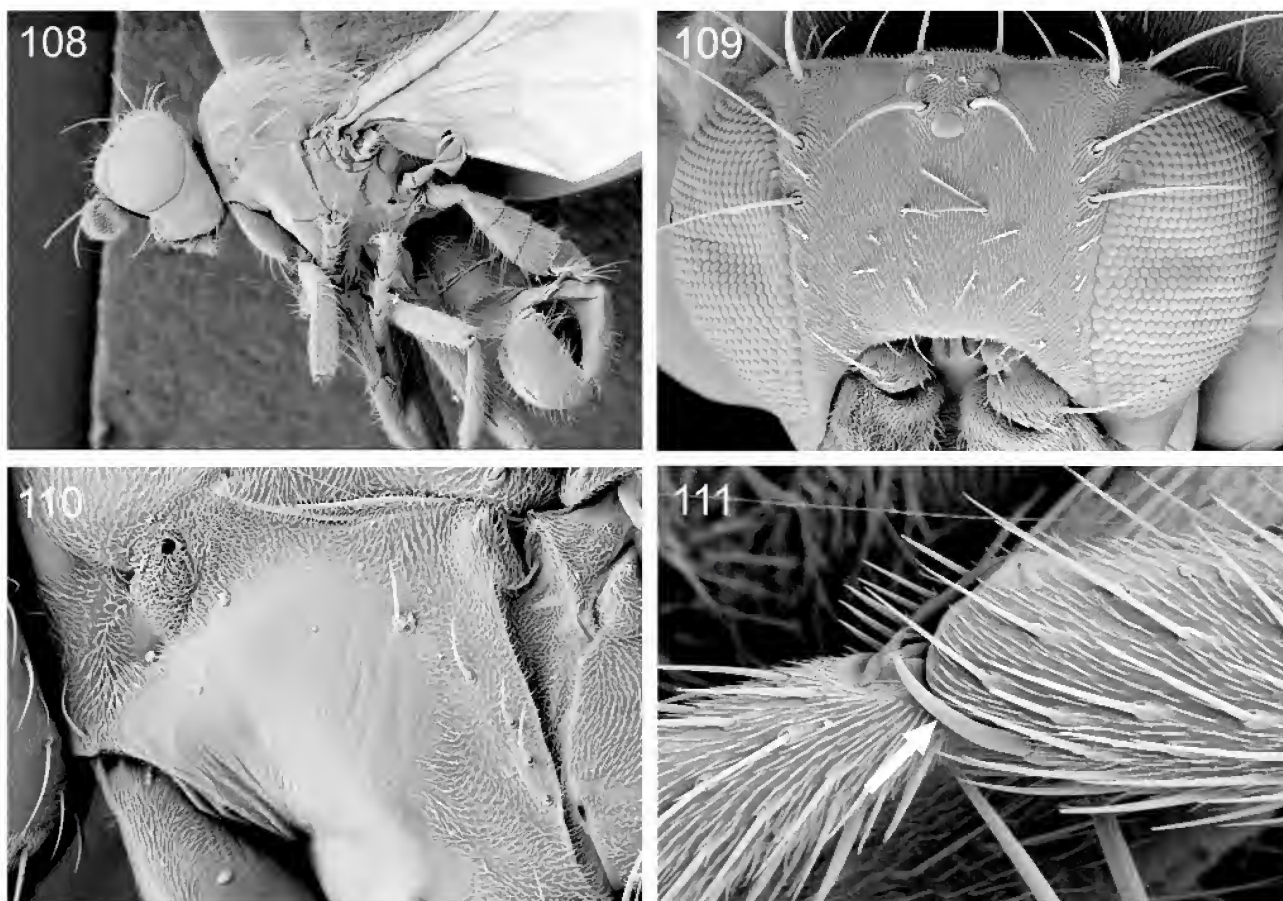
The specific epithet refers to Kiril B. Gorodkov, who has made an outstanding contribution to knowledge of the Heteromyzidae.

Borboroides shippi n.sp.

Figs 108–116

Material examined. HOLOTYPE. ♂, New South Wales: Mount Wilson, Blue Mountains [Waterfall Reserve, c. 900 m, 33°31'S 150°23'E], 12.iv.2004, D.K.M. (AM K219755). Mounted on card point, postabdomen in microvial on same pin. PARATYPES. New South Wales: 8♂♂, 26♀♀, Mount Wilson, April, Aug. Sept., Oct., 1970–2004, D.K.M. (AM, ANIC); 3♂♂, 2♀♀, Lahey's Creek Road, 12 km NW of Gulgong, April 1979, B.J.D., D.K.M. (AM); 7♂♂, 4♀♀, 8 miles [c. 13 km] N of Rylstone, Aug. 1956, D.K.M. (AM); 2♂♂, 4♀♀, Tinda Creek, Putty Road, 33°10'S 150°42'E, April, May 2002–2003, D.K.M. (AM); 13♂♂, 22♀♀, Putty Road, 41 km N of Colo River bridge, 33°11'S 150°41'E, May, June. Sept., 2002–2003, D.K.M. (AM, MV); 1♂, Colo Heights, 33°21'S 150°44'E, May 2002, D.K.M. (AM); 1♂, 1♀, Mount York, Blue Mountains, May 2003 D.K.M. (AM); 1♂, Katoomba, May 1958, G.H.H. (AM); 1♂, La Perouse, Botany Bay, 33°59'S 151°14'E, Oct. 2002, B.M., B.J.D. (MHNG); 2♂♂, 3♀♀, Rudy's Road turn-off, 15 km N of Jenolan, April 2004, B.J.D. (AM, MHNG).

Other material (including some lots without males, some with slightly atypical male genitalia characters, some from localities remote from type locality; ♂ g indicates that male genitalia have been checked for the lot or specimen and are in approximate agreement with type material; otherwise localities only given). New South Wales: Warrumbungles National Park (AM); Mount Royal State Forest, Singleton district (AM); Baerami Creek, near Denman (AM);



Figs 108–111. (108) *Borboroides shippi*, typical male (Putty Road). (109) Head of same, female. (110) Left propleural and mesopleural region of thorax of same. (111) Apex of right hind tibia, anterior view, subapical spur indicated.

Kanangra-Boyd National Park (several localities, AM); Murrumbateman (ANIC); Clyde Mountain, Braidwood district (ANIC); Mogo, near Bateman's Bay (ANIC). Australian Capital Territory: Canberra, ♂ g (ANIC); Blundell's (ANIC); Tidbinbilla (ANIC). Victoria: Swan Reach, ♂ g (AM); Providence Ponds Reserve, 27 km W of Bairnsdale, ♂ g (AM); Toolangi State Forest, 31 km S of Yea, ♂ g (AM); Saint Arnaud (ANIC); 4 miles [c. 6 km] W of Dimboola (ANIC). Tasmania: Mount Field National Park (AM); Lake Saint Clair (ANIC). South Australia: Yumali, near Mount Barker (ANIC); Hahndorf, near Mount Barker (ANIC); upper Ravine des Casoars, Kangaroo Island, ♂ g (AM). Western Australia: Williams, ♂ g (AM); 27 miles [c. 43 km] N of Bunbury, coast road (ANIC); 8 miles [c. 13 km] N of Bunbury (ANIC); Jalbarragup Road, 15 km S of Busselton, ♂ g (AM); Pemberton (ANIC); 9 miles [c. 14 km] W of Pemberton, ♂ g (ANIC); 3 miles [c. 5 km] NE of Pimelia, Pemberton district, ♂ g (ANIC); Mount Barker (ANIC); Napier, 16 miles [c. 26 km] N of Albany (ANIC); Bolganup Dam, Porongorup (AM); Porongorup National Park (ANIC); Thomas River, 63 miles [c. 101 km] E of Esperance, ♂ g (ANIC).

Description (male, female). Very small largely black fly, resembling *B. corynetes* in most characters and agreeing with description of that species except as indicated below.

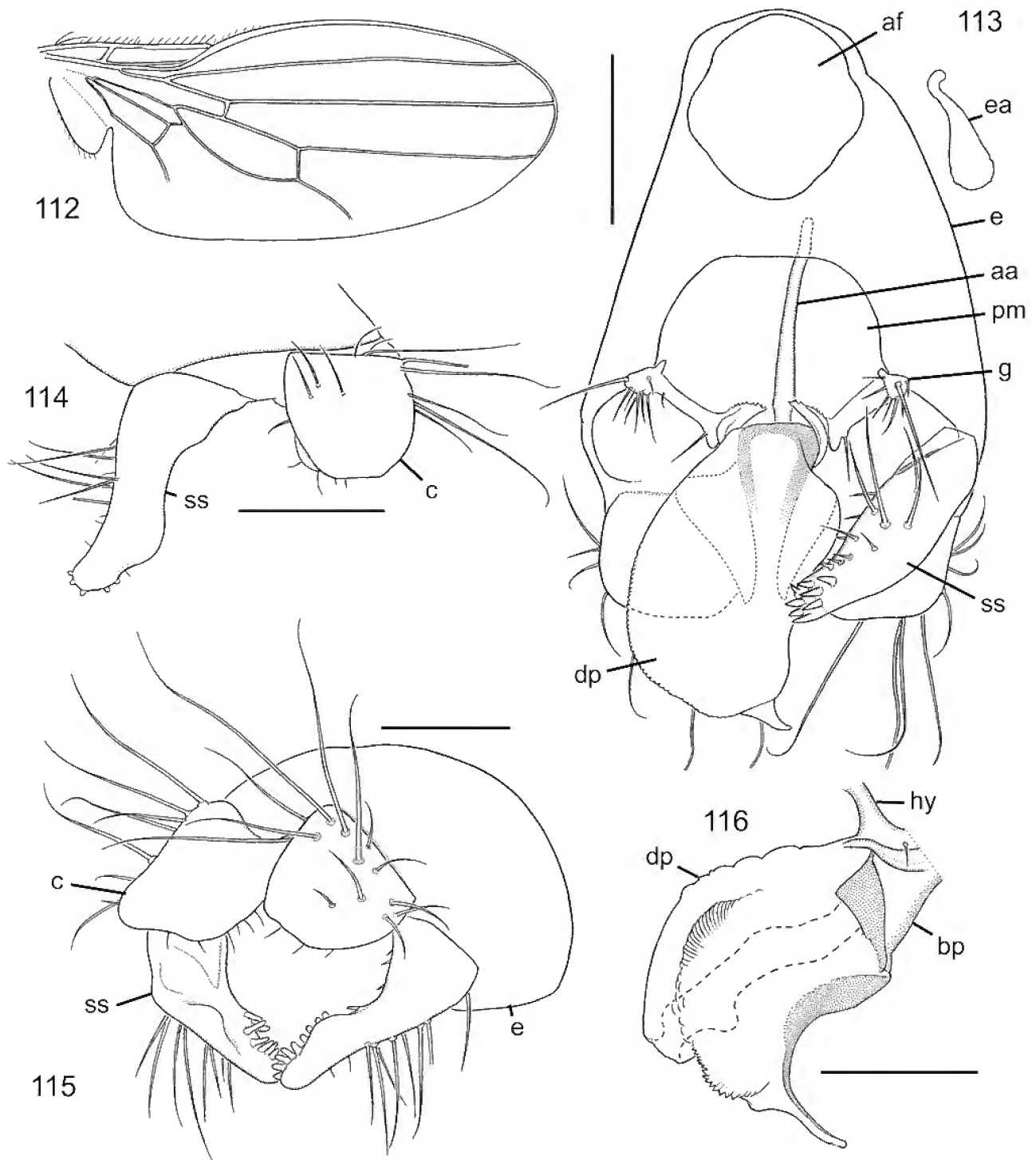
Coloration. Postfrons with distinct tawny-yellow anterior marginal zone of variable width, with subshining black zone on each side of ocelli often larger than in *B. corynetes*;

face tawny-brown to tawny-yellow; cheek usually tawny to tawny-yellow on anterior part, more extensively yellowish in males. Antennal segment 3 predominantly tawny-yellow in male, predominantly brown in female. Palpus tawny-yellow, sometimes more brownish in females. Thorax: hypopleuron with distinct zone of dense grey pruinescence on or very near posterior margin in addition to anterior pruinescent zone, or, infrequently, more extensively pruinescent on ventral part.

Head. Height of cheek c. 0.37–0.56 of height of eye. Prelabrum slightly smaller in male than in female. Dorsocentral bristles usually one well-developed pair or a small more anterior additional bristle distinguishable from setulae.

Thorax. Fore tibia not sexually dimorphic, often with weakly differentiated preapical dorsal bristle, without ventral excavation. Wing: apical section of vein 4 3.1–3.9 times as long as penultimate section.

Abdomen. Tergite 5 of male not markedly shorter than tergite 4. Male postabdomen: sternite 6 symmetrical, paired anterior prominences on its ventral angles produced into rounded lobes; epandrium with relatively large anterior foramen, with scattered coarse setulae, and with anteroventral bridge less extensive than in *B. fimbria* and *B. atra*; prehypandrial membrane extensive, with numerous short microtrichia, mostly arranged in short comb-like series; surstylus somewhat compressed in transverse-suboblique plane, concave on inner-posterior surface before mid-length, not strongly bent, but with distal third sloping inwards from the broadly rounded postero-external gibbosity, with few,



Figs 112–116. (112) *Borboroides shippi*, wing. (113) Epandrium and associated structures of same, anteroventral view, right surstylus and setulae on epandrium omitted; scale = 0.1 mm. (114) Left surstylus and cercus of same, direct lateral view; scale = 0.1 mm. (115) Holotype male of same, oblique posterior view of cerci and surstyli, scale = 0.1 mm. (116) Aedeagus of same, left lateral view, exposed parts only, surface structure simplified, lumen of distiphallus shown in broken lines; scale = 0.1 mm. *aa*, aedeagal apodeme; *af*, anterior foramen of epandrium; *bp*, basiphallus; *c*, cercus; *dp*, distiphallus; *e*, epandrium; *ea*, ejaculatory apodeme; *g*, gonite; *hy*, lateral hypandrial sclerite; *pm*, prehypandrial membrane; *ss*, surstylus.

large anterior setulae and, on distal part of inner surface, with numerous blunt, peg-like spinules; process at outer extremity of lateral hypandrial sclerite simple, with one long and several short setulae, no additional processes present between this and basiphallus; aedeagus resembling that of *B. corynetes*, with extensive fine parallel rugosity on lateral

convexity, the ridges becoming sharp and tooth-like between gonopore and acuminate apex, with pair of brown triangular sclerites on basal part of posterior surface; cercus very stout and rather short, basally articulated with epandrium, densely pubescent on most of outer surface, with setulae and mollisetae of various sizes, some of the largest inserted near

or on basal margin, its inner surface with broad gibbosity which is glabrous except for a few small setulae.

Dimensions. Total length, ♂ 1.0–1.8 mm, ♀ 1.1–2.3 mm; length of thorax, ♂ 0.56–0.85 mm, ♀ 0.57–0.98 mm; length of wing, ♂ 1.5–2.0 mm, ♀ 1.5–2.4 mm.

Distribution. Eastern New South Wales: widely distributed. Victoria: widely distributed but records sparse. Tasmania: single record. South Australia: southern districts, including Kangaroo Island. Western Australia: southwest district as far east as Thomas River. This is one of the most widely distributed species of the genus, only one other (*B. gorodkovi*) being known from both eastern and western states.

Notes

Borboroides shippi differs from most species of the *atra* group in the more extensively pruinose postfrons, without a distinct glossy zone in front of the anterior ocellus, but *B. menura*, *B. gorodkovi*, and *B. corynetes* agree to a variable extent in this character. From *B. menura* it differs in having any anterior dorsocentral bristle much shorter than the posterior one, in having several quite long posteroventral bristles on the fore femur, in the lack of strong apical curvature in vein 2, also in the quite different male cercus, surstylus, etc. Those specimens of *B. shippi* with more developed dorsocentral bristles can be distinguished from *B. gorodkovi* by the much smaller hind tibial subapical spur, by having that part of the mesopleuron smooth and glossy where it meets the upper part of the fore-coxal cavity, and by the differently shaped discal cell. The most closely related species is *B. corynetes*, from which it differs as indicated under that species and in the key to species.

Borboroides shippi as here delimited shows variation in the distribution of pleural microtrichiation, in the size of the subapical spur of the hind tibia, and in the precise shape of the surstylus and cercus of the male. There appear to be intermediate conditions connecting the more extreme variants, and the variation does not show a consistent geographic correlation. These conclusions were reached after a prolonged but not exhaustive study of the available material. The specific distinction of this species from *B. corynetes* is unambiguous, but occasional female specimens may be hard to place.

Borboroides shippi has been collected around wombat dung baits and on old carcasses (wombat, domestic fowl), often but not always in natural wombat habitats.

The specific epithet refers to Erik Shipp, formerly of the University of New South Wales, who kindly invited me on the field trip in 1956 when I first collected this species.

Borboroides corynetes n.sp.

Figs 117–119

Material examined. HOLOTYPE. ♂, New South Wales: Rudy's Road turn-off, 15 km N of Jenolan, 24.iv.2004, B.J.D. (AM K219756). Mounted on card point after initial preservation in ethanol. PARATYPES. New South Wales: 29♂♂, 4♀♀, same data as holotype (AM, ANIC, USNM); 1♀, 10 km SW of Ebor, 24.vi.1976, Z.R.L. (ANIC); 2♂♂, 1♀, Mount Wilson, Aug. Sep. 2002, D.K.M. (AM); 1♂, 1♀, Mount York, Blue Mountains, 6.vii.1986, D.K.M. (AM);

1♂, 3♀♀, Kanangra Road, 9.2 km S of Oberon–Jenolan Road junction, 26.iv.2004, B.J.D. (AM); 1♂, Black Springs fossicking area, Vulcan State Forest, c. 27 km SSW of Oberon, 4.v.2003, B.J.D. (AM); 1♀, Kunama, near Batlow, 11.viii.1961, D.H.C. (ANIC).

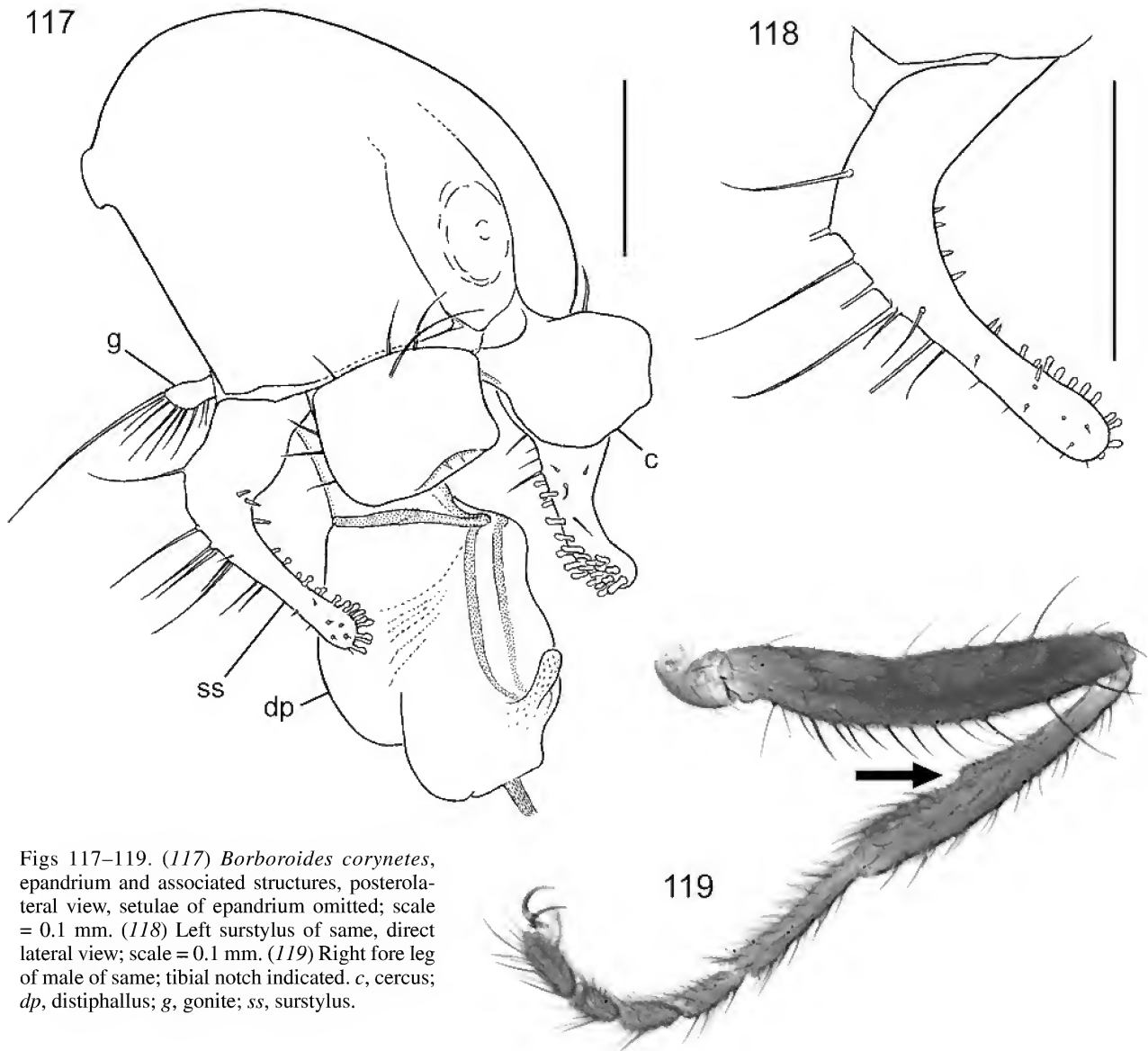
Other material. Tasmania: 1♂, Tom Gibson Nature Reserve, 41°46'S 147°18'E, 29.iv.2004, M.F. (AM); 1♀, Lake Saint Clair, 14.ii.1964, A.L.D., M.D.M. (ANIC).

Description (male, female). Small to minute black fly with unmarked wings.

Coloration. Head, thorax, abdominal tergites, and sternites with general black ground colour. Postfrons entirely black or anteriorly dark brown, but without tawny anterior marginal zone, with dark grey pruinescence on most of surface except for a small subshining zone with very weak fingerprint sculpture lateral to each posterior ocellus, without shining median zone in front of anterior ocellus; face blackish with thick grey pruinescence and often narrow tawny zone on each side; cheek dark brown to blackish, without tawny zone, with narrow grey-pruinose zone on lower margin. Antenna largely blackish; segment 3 with basal tawny zone on median surface. Prelabrum and palpus blackish, latter with well-developed grey pruinescence. Mesoscutum and scutellum thinly brown-pruinose; mesopleuron grey pruinose on upper margin and very broadly so on posterior margin so that pruinescence extends almost to centre; sternopleuron with grey pruinescence along much of upper margin; hypopleuron with grey to yellowish pruinescence anteriorly, usually glossy brown without pruinescence on posterior part or sometimes with trace only. Preabdominal tergites extensively grey-brown pruinose, appearing black towards lateral margins when viewed from certain angles; in male, epandrium extensively thinly pruinose, shining; in female tergite 6 entirely pruinose.

Head higher than long; eye slightly longer than high; setulae on anterior half of postfrons variously inclined, those on either side of median line mostly incurved and inclined forwards; face with slightly raised median line, concave on either side; height of cheek c. 0.48–0.70 of height of eye; ocellar bristle at least as long as posterior fronto-orbital bristle; fronto-orbital bristles subequal in length, both strongly inclined and curved outwards. Antenna: segment 3 rounded, scarcely longer than high, normally slightly decumbent; arista slightly shorter than greatest diameter of eye; segment 6 with many short hairs on whole length. Prelabrum moderately small, not noticeably sexually dimorphic; palpus moderately short and slender.

Thorax stout; intradorsocentral setulae usually in four fairly regular rows; mesopleuron with few rather small setulae; the following thoracic bristles present: humeral, presutural, 1 + 1 notopleurals, supra-alar, postalar, 0 + 1 well-developed dorsocentrals but often a more anterior setula differentiated as a small second dorsocentral, two pairs of large scutellars, large posterior sternopleural and one or two small anterior ones; posterior intra-alar reduced to a setula. Fore femur with several posterodorsal and posteroventral bristles; mid femur with few anterior bristles of variable size; hind femur with preapical dorsal bristle; fore tibia without preapical dorsal bristle, unmodified in female, in male with ventral to posteroventral depression or excavation just beyond mid-length, ventral setulae well developed beyond depression, much less so basad of depression; mid tibia with



Figs 117–119. (117) *Borboroides corynetes*, epandrium and associated structures, posterolateral view, setulae of epandrium omitted; scale = 0.1 mm. (118) Left surstylus of same, direct lateral view; scale = 0.1 mm. (119) Right fore leg of male of same; tibial notch indicated. *c*, cercus; *dp*, distiphallus; *g*, gonite; *ss*, surstylus.

pair of large approximated preapical dorsal bristles, one anterior bristle a little basad of these, and a ventral and an anteroventral subterminal spur; hind tibia with long preapical dorsal bristle and curved anteroventral subapical spur slightly shorter than greatest diameter of tibia. Wing as described for *B. fimbria* in most features; anterior crossvein meeting vein 4 at or distinctly before mid-length of discal cell; apical section of vein 4 3.2–4.2 times as long as penultimate section; anal crossvein straight or slightly curved, anal cell posterodistally somewhat obtuse or right-angled.

Abdomen. Sternite 1 well sclerotized across entire width; tergite 5 markedly shorter than tergite 4 in male, *c.* as long in female; sternite 5 in male almost as long as and much wider than sternite 4, with posterior marginal bristles, the outermost longest, in female similar to sternite 4. Male postabdomen: tergite 6 much reduced, medially desclerotized, consisting of two narrowly transverse plates; spiracle 6 well developed; thickened anterior band of sternite 6 heavily developed on each side, apparently symmetrical, with anterior lobe at each lateroventral angle; spiracle 7 not located; protandrial region of segment 8 stout, broadly sclerotized ventrally; with pair of

prominent posterior condyles articulating with epandrium; epandrium almost ovoid, not much produced and attenuated at anterior foramen, with scattered setulae; surstylus, in lateral view, very oblique but not much broadened basally (though transversely broadened and tumid), with slender distal part inwardly and posteriorly directed from before mid-length, thence becoming almost straight, with well-developed anterior setulae and numerous club-shaped spinules, many of them apically rounded, on inner surface and concentrated towards apex; lateral process of hypandrium particularly prominent with long setulae, one or two of them particularly long; basiphallus of aedeagus short, subcylindrical, with pair of posterior paramedian sclerotized strips; distiphallus large and inflated, largely membranous, but with extensive fine parallel rugosity, minutely hispid on distal surface anteriorly to posteriorly directed attenuate apex, at base with transverse sclerotized band on each side arising from apex of strip on basiphallus, these together corresponding to paired sclerotized triangles of *B. shippi*; cercus extremely stout (broad and thick) flattened or explanate on terminal surface, densely pubescent, with some longer setulae. Female

postabdomen: cercus elongate, with numerous fine setulae, apical ones longer.

Dimensions. Total length, ♂ 1.5–1.6 mm, ♀ 1.7–2.0 mm; length of thorax, ♂ 0.59–0.78 mm, ♀ 0.70–0.79 mm; length of wing, ♂ 1.7–2.1 mm, ♀ 2.2–2.3 mm.

Distribution. New South Wales: widely distributed in highlands. Tasmania: few records, including lowlands and highlands.

Notes

Among species of the *atra* group, *B. corynetes* agrees with *B. gorodkovi* and *B. shippi* in the extensively pruinose postfrons with no median glabrous zone in front of anterior ocellus. Unlike those two species, *B. corynetes* has no yellow to tawny zone on the anterior margin of the postfrons and the palpus is darker, greyish brown rather than yellowish. In contrast to *B. gorodkovi*, *B. corynetes* has usually only one pair of dorsocentral bristles, or at most one rudimentary second pair, no prescutellar acrostichal pair, the pleural region has no grey-pruinose line laterally bordering the fore-coxal foramen, and the subapical spur of the hind tibia is much smaller. *Borboroides corynetes* also differs from other species in its male genitalia, e.g., in the form of the surstylus; and the modification of the fore tibia in the male (Fig. 119) is unique in the genus.

Most of the specimens collected by B.J.D. and D.K.M. were around wombat dung baits.

The specific epithet is a Greek noun meaning club-bearer, in reference to the armature of the surstylus.

Borboroides petiolus n.sp.

Figs 120–124

Material examined. HOLOTYPE. ♂, New South Wales: 10 km N of Colo Heights (i.e. from Upper Colo road junction), 9.ix.2005, D.K.M. (AM K219757). Near old wombat carcass. Mounted on card point. PARATYPES. New South Wales: 6♂♂, 4♀♀, same data as holotype, except some 12.ix.2005 (AM, USNM); 3♂♂, 1♀, Goonoo State Forest, 5 mi. [c. 8 km] S of Mendooran, May 1970, G.D., G.A.H., D.K.M. (AM, ANIC); 1♂, Kandos, near Rylstone, June 1970, G.D. (AM); 1♂, Kanangra-Boyd National Park, 1 km N of Boyd River bridge, Oct. 2005 D.K.M. (AM); 2♂♂, Tantawangalo State Forest, near Candelo, May 1989, D.K.M. (AM).

Description (male, female). Very small largely blackish fly with unmarked wing, resembling *B. fimbria* except in male postabdominal characters and agreeing with description of that species except as indicated below.

Coloration. Head, thorax and abdominal tergites probably originally black, but faded to dark brown in older specimens. Postfrons broadly tawny-orange on anterior margin, with median glossy zone in front of anterior ocellus not as wide as distance between posterior ocelli and much narrower than lateral subshining zones, extending from anterior ocellus to c. 0.3 of distance to ptilinal suture. Mesopleuron with subshining, finely rugose and slightly pruinose small central zone, with narrow posterior grey-pruinose zone not narrowed ventrally, with little grey pruinose on lower part of margin of fore coxal foramen only; sternopleuron

with grey-pruinose mark surrounding bristle; hypopleuron with posterior grey-pruinose zone separated from glossy posterior margin. Tarsi tawny-yellow to brownish. Abdomen of female: tergite 4 largely glossy black with small median dark-pruinose zone; tergite 5 glossy black with little pruinose on anterior margin only; tergite 6 entirely grey-pruinose. In male tergites 4 and 5 largely grey-pruinose, with small bare lateral zones.

Head. Height of cheek 0.41–0.51 of height of eye. Prelabrum rather small, not very obviously sexually dimorphic.

Thorax. Chaetotaxy as in *B. fimbria*. Hind tibia with anteroventral subapical spur almost as long as greatest diameter of tibia. Wing: anterior crossvein meeting vein 4 near mid-length of discal cell; apical section of vein 4 c. 3.3–3.8× as long as penultimate section; basal crossvein somewhat oblique but forming distinct angle with penultimate section of vein 5, which is generally less strongly curved than in *B. fimbria*, *B. atra* and related species.

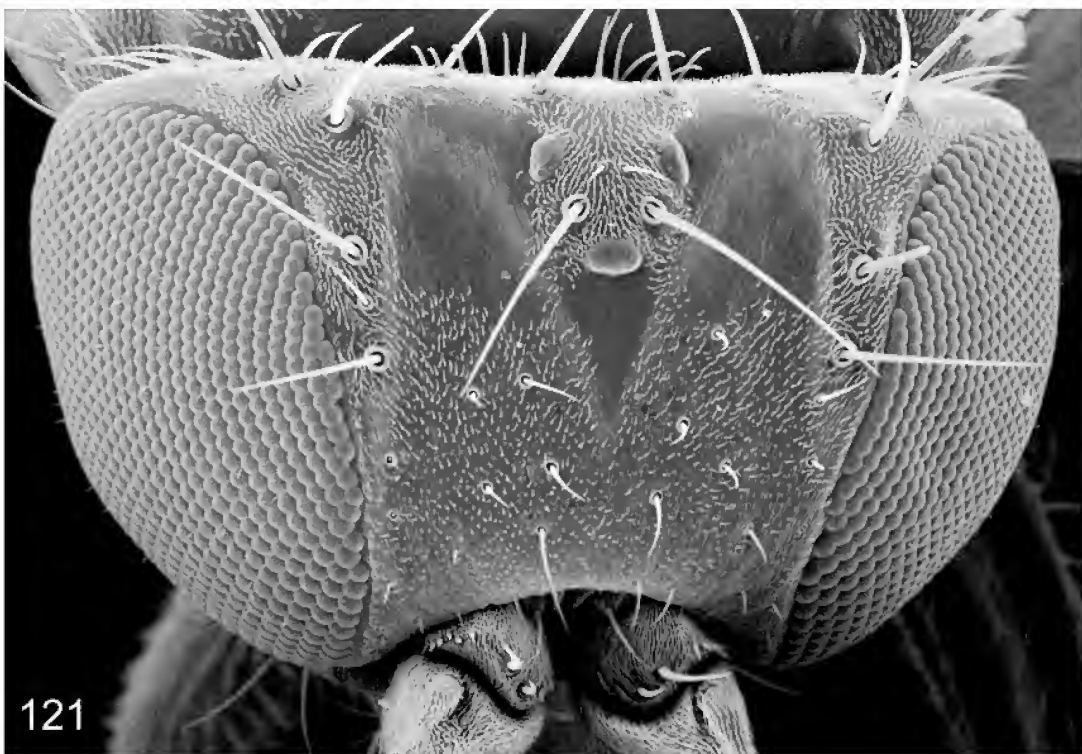
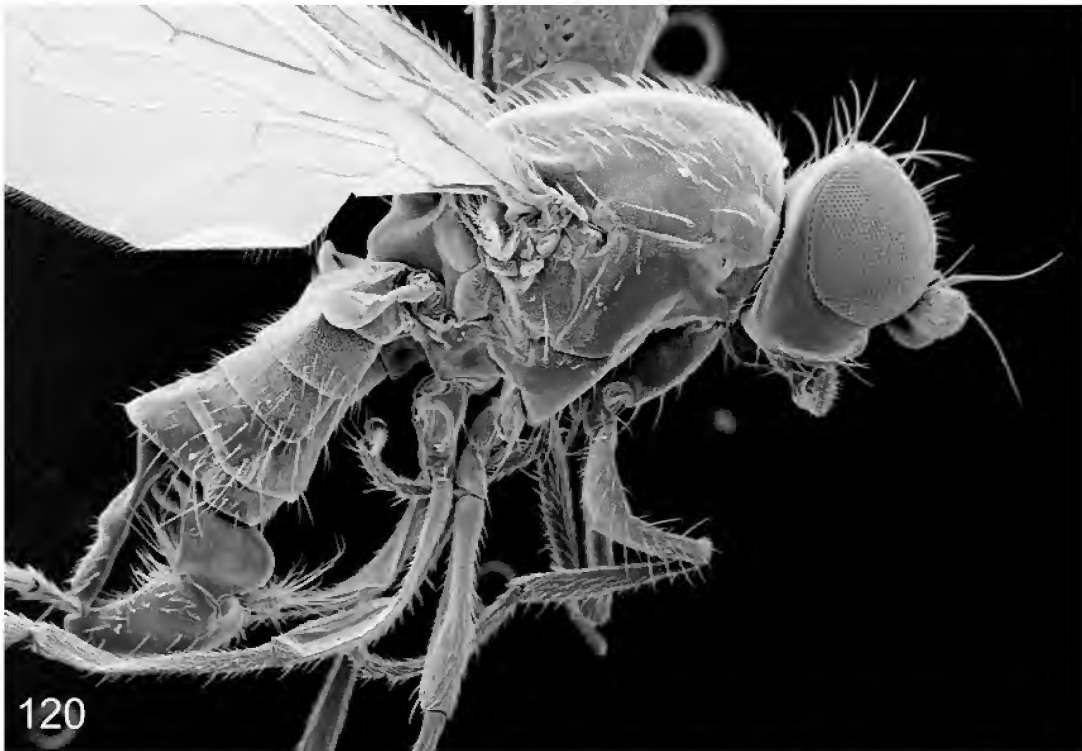
Abdomen. Male postabdomen: tergite 6 vestigial; compound protandrial sclerite apparently symmetrical, sternite 6 encircling postabdomen, without spur-like extensions; region of sternite 7 extensively sclerotized, not separated from sternite 6; sternite 8 forming petiole-like tube, much more elongate than in *B. fimbria* and related species and not expanded anteriorly, with pair of very prominent posterior condyles; epandrium very broadly subtriangular, nearly four times as wide as sternite 8 at mid length of latter, with anteroventral bridge well sclerotized but less extensive than in *B. fimbria*; prehypandrial membrane with very short microtrichia on central and posterior parts mostly not in linear series; surstylus conspicuously large, subquadrate, broader than long, its distal margin much longer than basal margin, with group of many spine-like setulae inside distal margin, especially densely packed anteriorly, and separate very dense anterodistal patch of spinules, with setulae on outer surface few and minute; broad lateral process of hypandrium with compressedly clavate, long-hirsute anterior lobe and less prominent short-setulose posterior lobe; aedeagus slender (not studied in detail); cercus elongate, clavate, with many long setulae, especially on distal part, and with basal, anterolaterally extended gibbous foot bearing two or three setulae; transverse bridge connecting bases of cerci with a large setula in front of base of each cercus. Female postabdomen as given for *B. fimbria*.

Dimensions. Total length, ♂ 1.6–1.8 mm, ♀ 1.5–2.1 mm; length of thorax, ♂ 0.73–0.93 mm, ♀ 0.86–0.97 mm; length of wing, ♂ 1.6–1.9 mm, ♀ 2.1–2.2 mm.

Distribution. New South Wales: central and southern districts—scattered records.

Notes

Borboroides petiolus is a distinctive species of the *atra* group. It possesses a defined median glossy zone on the postfrons immediately in front of the anterior ocellus, unlike *B. gorodkovi*, *B. corynetes*, and *B. shippi*; this zone is much smaller than in *B. atra*, *B. fimbria* and related species, but not as small as in *B. menura*. The pattern of pruinose on the hypopleuron is distinct from these species, for, although it has a substantial grey-pruinose posterior zone, this is well clear of the narrowly glossy posterior margin. Features

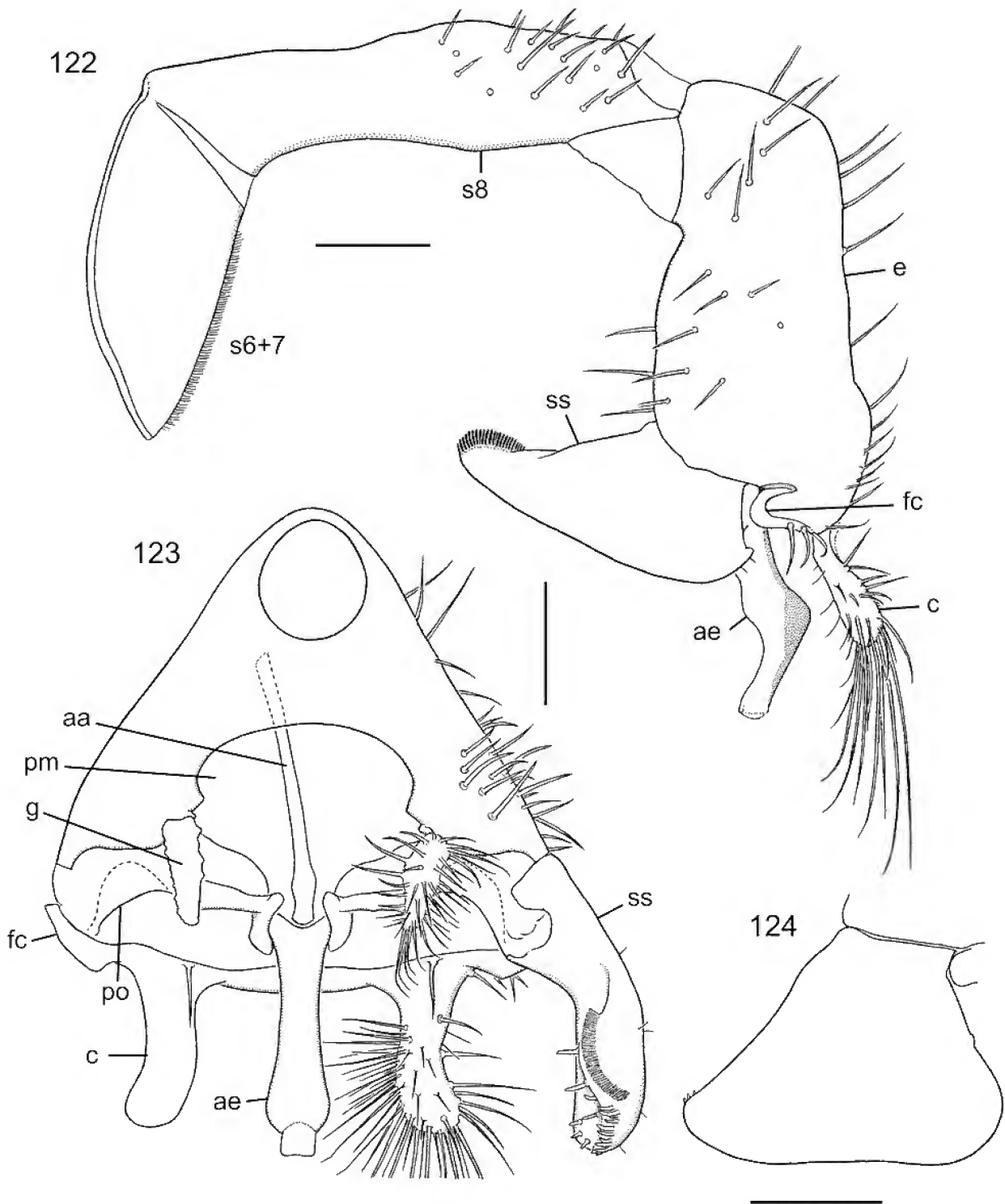


Figs 120–121. (120) *Borboroides petiolus*, male. (121) Dorsal view of head of same.

of the male postabdomen are recognizable from those of all other species on whole dried specimens; these include the long, slender segment 8 contrasting with the very broadly subtriangular epanthrium, the broadly subquadrate surstylus almost without setulae on its outer surface, and the clavate, widely separated cerci.

Borboroides petiolus has not been taken at wombat dung baits. The specimens I have collected were on or near carcasses (kangaroo, wombat, domestic fowl).

The specific epithet is a noun in botanical Latin, referring to the petiole-like segment 8 of the male abdomen.



Figs 122–124. (122) *Borboroides petiolus*, male postabdomen, left lateral view; scale = 0.1 mm. (123) Epandrial and hypandrial structures of same, anteroventral view, all macrotrichia and surstylus omitted from right side; scale = 0.1 mm. (124) Left surstylus of same, outer surface view; scale = 0.1 mm. *aa*, aedeagal apodeme; *ae*, aedeagus; *c*, cercus; *e*, epandrium; *fc*, outer basal foot of cercus; *g*, gonite; *pm*, prehypandrial membrane; *po*, lateral hypandrial pouch; *ss*, surstylus; *s6+7*, combined sternites 6 and 7; *s8*, sternite 8.

***Borboroides fimbria* n.sp.**

Figs 11, 12, 125–129

Material examined. HOLOTYPE. ♂, New South Wales: Mount Wilson [Blue Mountains; Waterfall Reserve, c. 900 m, 33°31'S 150°23'E], 20.ix.2002, D.K.M. (AM K219758). Mounted on card point. PARATYPES. New South Wales: 96 ♂♂, 48 ♀♀, Mount Wilson, March, April, May, Aug., Sept., Oct. 1957–2003, D.K.M. (AM, ANIC, BM, CNC, USNM).

Other material (localities only given). New South Wales: 4 miles [c. 6 km] S of Coolongolook, Nahiab district (ANIC); 5.4 km NNE of Stroud (AM); Tinda Creek, Putty Road (AM); Putty Road, 41 km N of Colo R. bridge (AM); Colo Heights (AM); Euroka Clearing, 6 km S of Glenbrook (AM); Kanangra Road, 14.2 km S of Jenolan–Oberon road junction (AM); Boyd R. crossing, Kanangra–Boyd National Park (AM, NAT, TAU); Otford (AM); Minnamurra Falls (AM, ANIC); Araluen (ANIC); Tantawangalo Forest, near Candelo (AM). Victoria: Nowa Nowa (AM); 7 km S of Bruthen (AM, BM); Providence Ponds Reserve, 32 km W of Bairnsdale (AM); Toolangi State Forest, 31 km S of Yea (AM, MV, USNM); 11 km E of Warburton (AM, MNHG); Dom Dom Saddle, 17 km NE of Healesville (AM); near Mount Juliet, 9 km E of Healesville (AM, ANIC, MV); Myer's Creek, near Healesville (ANIC). Tasmania: Marakooa Caves, near Mole Creek (AM); Weldborough Pass (AM); Mount Field National Park (including Russell Falls) (AM); Ferntree, near Hobart (AM); 8 km W of Geeveston (AM, ANIC, TDPI); northern foot of Hartz Mountains (AM); 3 km S of Barnes Bay, Bruny Island (AM); The Neck, Bruny Island (AM); Gilham's Beach, Recherche Bay (AM).

Description (male, female). Small to minute blackish fly with unmarked wing.

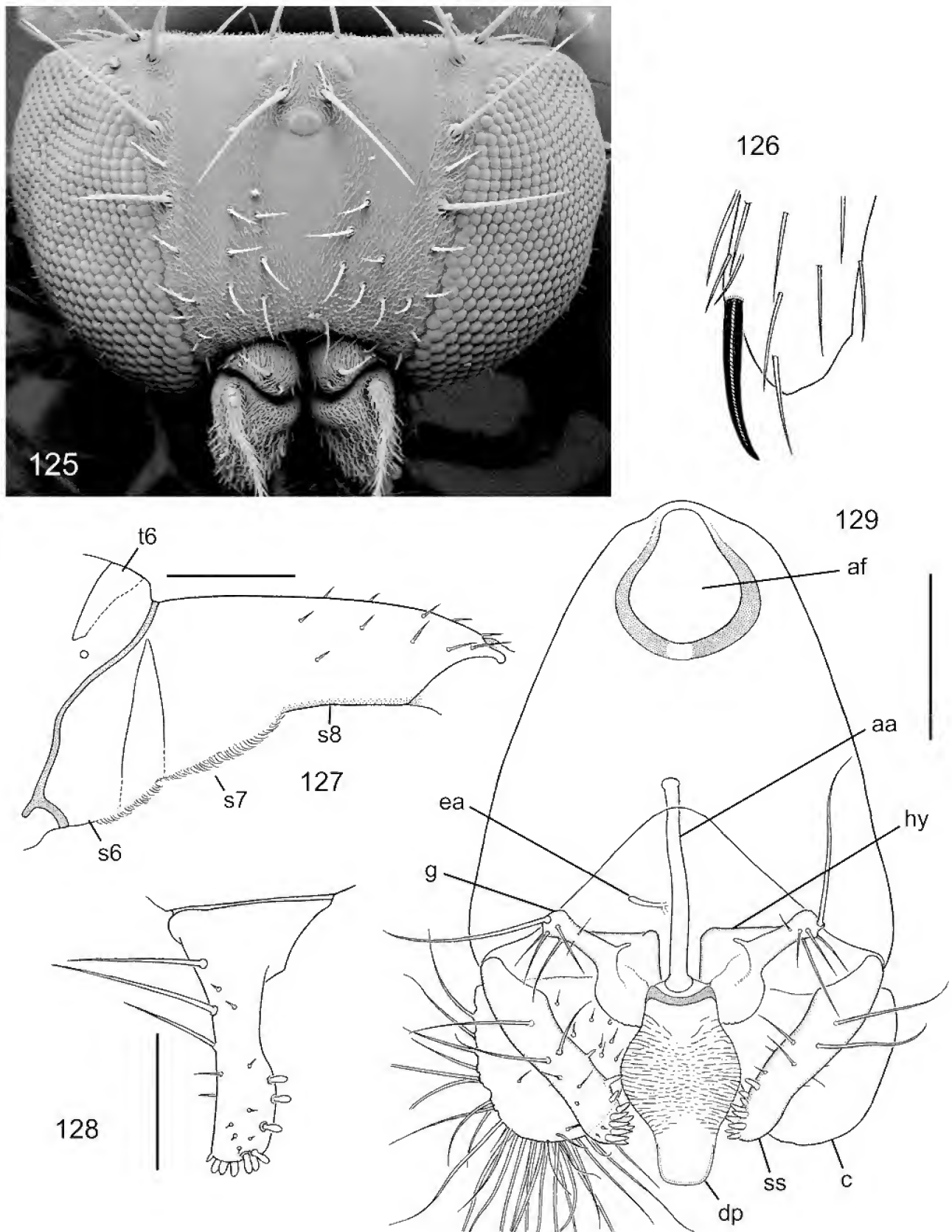
Coloration. Head, thorax and abdominal tergites black. Postfrons black, sometimes narrowly tawny on anterior margin, without distinct fingerprint sculpture, with dark greyish pruinescence except on three large glossy zones—ovate median zone extending from anterior ocellus to c. 0.6 of distance to ptilinal suture and pair of well defined lateral zones extending well in front of anterior ocellus but not so far forward as median zone, truncated anteriorly, separated from median zone by distinct, narrow pruinescent stripe; lower margin of cheek narrowly grey-pruinescent. Antenna dark brown; segment 3 with diffuse tawny basal zone. Prelabrum black; palpus tawny to tawny-brown. Mesoscutum and scutellum thinly brown-pruinescent; mesopleuron largely shining brown-black, with narrow grey-pruinescent zone on upper and posterior margins, on latter markedly narrowed below; sternopleuron usually with trace only of upper marginal pruinescence, mainly near bristle; hypopleuron shining brown to blackish, with zone of yellowish pruinescence anteriorly and posterior zone of grey pruinescence extending approximately to posterior margin. Legs brown; fore coxa largely dull yellowish, with dense pale pruinescence on anterior surface. Wing membrane faintly uniformly smoky; veins brown. Halter brown, with pale yellow capitellum. Abdominal tergites in male with grey-brown pruinescence except for variable glossy zone on lateral margins of tergites 4 and 5; in female tergites with brown pruinescence except on large lateral zones of tergites 3 and 4, tergite 5 largely glossy, with slightly variable grey-

pruinescent zones on median line and on anterior margin; tergites 6 and 7 entirely dark grey-pruinescent.

Head much higher than long; eye subcircular or slightly higher than long; postfrons with setulae on anterior half mostly inclined forwards and mesad; face concave; height of cheek 0.25–0.36 of height of eye; ocellar bristle as long as posterior fronto-orbital; postvertical bristle nearly as long as posterior fronto-orbital; anterior fronto-orbital bristle slightly shorter than posterior one, directed outwards. Antenna: segment 3 decumbent, rounded, very slightly longer than high; arista slightly shorter than greatest diameter of eye; segment 6 with many short hairs no longer than diameter of segment 5. Prelabrum small in male, larger and broadly anteriorly prominent in female; palpus moderately short and slender.

Thorax stout; intradorsocentral setulae in two to three pairs of irregular rows anteriorly, sparser posteriorly; mesopleuron with few short posterior setulae; the following thoracic bristles present: humeral, presutural, 1 + 1 notopleurals, supra-alar, postalar, 0 + 1 well-developed dorsocentrals, two pairs of large scutellars, large posterior sternopleural and sometimes small anterior one; posterior intra-alar small or undifferentiated. Fore femur with about four posteroventral bristles and few variably developed posterior to posterodorsal bristles; mid femur with a series of c. 4–6 anterior bristles; hind femur with preapical dorsal bristle present or absent; fore tibia without distinct preapical dorsal bristle; mid tibia with usual pair of approximated preapical dorsal bristles, one anterior bristle a little basad of these, and an anterior and a ventral subapical spur; hind tibia with distinct preapical dorsal bristle and curved anteroventral subapical spur c. as long as tibial diameter. Wing: costa without special armature, noticeably weakened just beyond humeral crossvein; subcosta not conspicuously weakened at that level, sclerotized for some distance beyond, obsolete on c. distal third of length of second costal cell; anterior crossvein meeting vein 4 slightly before mid-length of discal cell; vein 2 distally almost parallel with vein 3, though often slightly curved; apical section of vein 4 3.6–4.7× as long as penultimate section; basal crossvein very oblique, aligned with penultimate section of vein 5, which is strongly curved; anal cell posterodistally somewhat acute to right-angled; distal section of vein 6 c. as long as anal crossvein or slightly longer.

Abdomen. Tergite 5 almost as long as tergite 4 in male, slightly longer in female; sternite 5 shorter than preceding sternites and undivided in male, markedly longer in female; sternite 1 sclerotized on whole width. Male postabdomen: protandrium approximately symmetrical; tergite 6 undivided, narrowly transverse, with spiracle just below each lateral margin; compound protandrial sclerite (synsternite 6–8) with narrow anterior marginal darkly pigmented annular band (largely representing sternite 6) encircling abdomen, with pair of short anteroventral spur-like extensions (as in *B. atra*); sternite 7 broad, densely microtrichose ventrally, partly divided by narrow desclerotized ventral zone, completely fused with sternite 8 to form slender, curved, completely sclerotized tube, with pair of slender posterior condyles for articulation with epandrium; epandrium almost ovoid, not produced and attenuated at anterior foramen, on posterior surface desclerotized medially on c. posterior two thirds of length, with scattered short setulae; anteroventral bridge occupying more than one third of length of epandrium;



Figs 125–129. (125) *Borboroides fimbria*, head, frontal view. (126) Apex of hind tibia of same, anterior view. (127) Hypandrial segments of same, left lateral view; scale = 0.1 mm. (128) Surstylus of same, direct lateral view; scale = 0.05 mm. (129) Epandrial and hypandrial structures of same, anteroventral view; setulae omitted from epandrium and left cercus; scale = 0.1 mm. *aa*, aedeagal apodeme (seen through prehypandrial membrane); *af*, anterior foramen of epandrium; *c*, cercus; *dp*, distiphallus; *ea*, ejaculatory apodeme (seen through prehypandrial membrane); *g*, gonite; *hy*, lateral hypandrial sclerite; *ss*, surstylus; *s6–8*, sternites 6 to 8; *t6*, tergite 6.

prehypandrial membrane with minute microtrichia mostly grouped into very small combs; surstylus stoutly rod-like, almost straight, broadened basally, rounded apically, with sparse small setulae and few very long anterior ones, with short blunt spines crowded on inner surface near apex; lateral hypandrial sclerite with rounded process at epandrial end bearing several fine setulae and one very long setula; aedeagus stout, with basiphallus reduced to a sclerotized annulus; anterior surface of distiphallus with many fine, sharp transverse ridges, much of posterior surface covered by a brown sclerite, clustered surface filaments absent; gonopore terminal; aedeagal apodeme long, slender; cerci separate from each other and from proctiger, articulated with epandrium on membranous line, each large and broadly rounded, with many setulae and mollisetae, some of distal mollisetae on posterior surface very long and forming conspicuous fringe. Female postabdomen abruptly narrowed from segment 6; tergite 6 undivided, with straight posterior margin; sternite 6 also undivided; cercus elongate, obtuse, but not at all thickened apically.

Dimensions. Total length, ♂ 1.1–1.5 mm, ♀ 1.2–1.8 mm; length of thorax, ♂ 0.53–0.75 mm, ♀ 0.62–0.81 mm; length of wing, ♂ 1.4–1.8 mm, ♀ 1.6–2.0 mm.

Distribution. New South Wales: widely distributed from Napiac district southwards, but not extending as far inland as *B. atra* and some other species. Victoria: widely distributed in eastern half of state. Tasmania: widely distributed. *Borboroides fimbria* is among the most abundant species of *Borboroides* in New South Wales, Victoria, and Tasmania, apparently particularly but not exclusively in natural wombat habitats.

Notes

Borboroides fimbria can be distinguished among other species of the *atra* group with only one dorsocentral bristle and pale yellow capitellum by the three separate shining black zones, all of which extend in front of level of anterior ocellus, on the otherwise pruinulent postfrons, the ventrally much narrowed pruinulent zone on the posterior margin of the mesopleuron, and the moderately large anteroventral subapical spur on the hind tibia. In the male the large, plate-like, conspicuously long-fringed cercus is diagnostic, and in the female the complete median pruinulent zone on the full length of tergite 5. Females and males with retracted genitalia can be slightly difficult to distinguish from related species, e.g., *B. bulberti* and perhaps *B. acumen*.

Borboroides fimbria has been collected in large numbers around wombat dung baits, but is also attracted to kangaroo dung and various old vertebrate carcasses.

The specific epithet is a Latin noun meaning a fringe or element of a fringe, in reference to the fringed cercus of the male.

Borboroides bulberti n.sp.

Figs 130–139

Material examined. HOLOTYPE. ♂, New South Wales: Mount Wilson [Blue Mountains; Waterfall Reserve, c. 900 m, 33°31'S 150°23'E], 24–25.iii.2002, D.K.M. (AM K219759). Mounted on card point. PARATYPES. New South Wales: 20♂♂, 11♀♀, Mount Wilson, March, May, Sept., Oct., April 2002–2004, D.K.M. (AM, ANIC, USNM); 1♂, 7♀♀, Putty Road, 41 km N of Colo R. bridge, c. 220 m, May, June, Sept. 2002–2003, D.K.M. (AM); 2♂♂, 1♀, Colo Heights, 33°21'S 150°44'E, May 2002, D.K.M. (AM).

Other material (localities only given). Victoria: 7 km SW of Bruthen (AM); near [northern foot of] Mount Juliet, 9 km E of Healesville (MV).

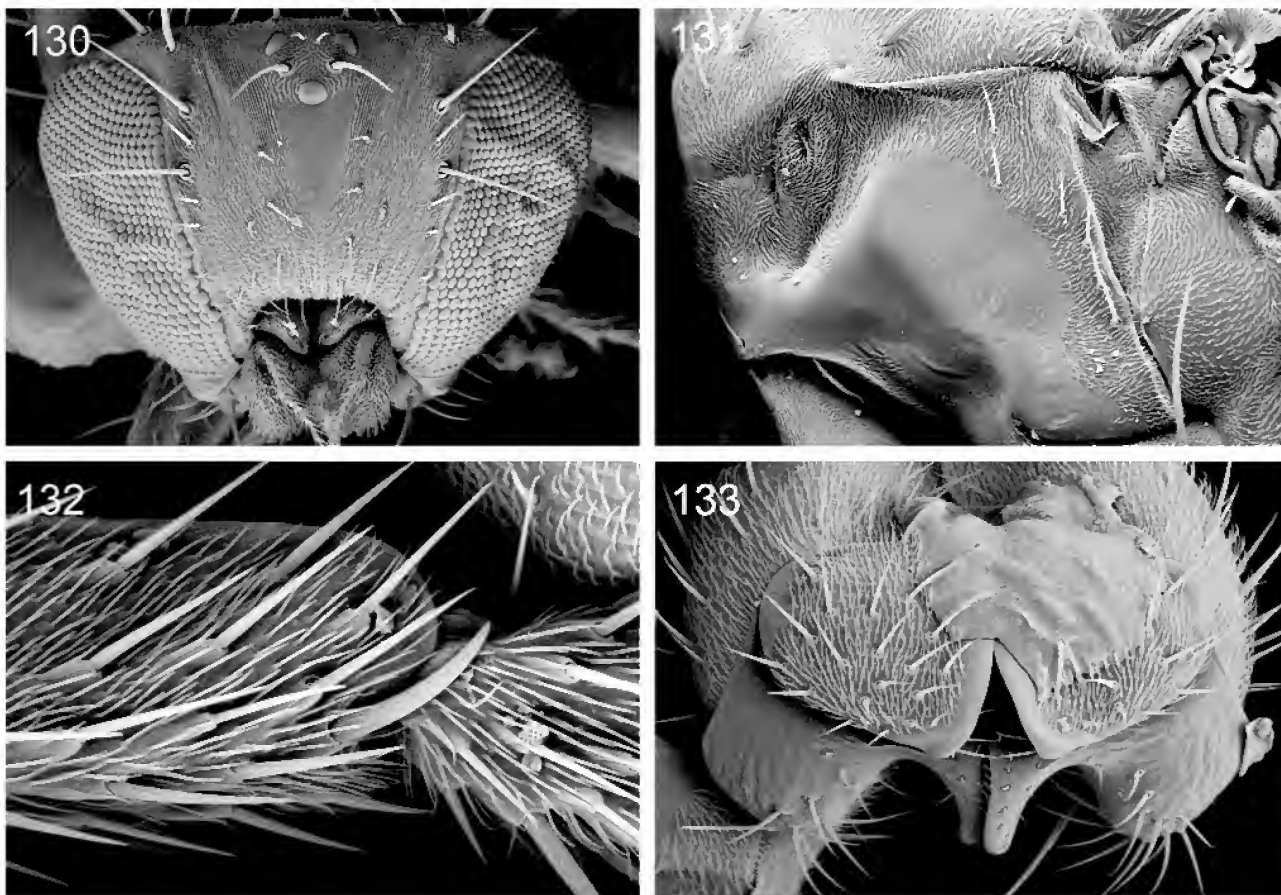
Description (male, female). Very small blackish fly, resembling *B. fimbria* and agreeing with description of that species, except as indicated below.

Coloration mostly as given for *B. fimbria*. Postfrons extensively grey-pruinulent, with subtriangular median glossy zone immediately in front of median ocellus, extending c. halfway to ptilinal suture or slightly less, but with subshining zone lateral to ocelli smaller and less distinct, thinly pruinulent as well as ridged; area between fronto-orbital bristles and median glossy zone almost entirely pruinulent. Abdomen of female: tergite 5 pruinulent anteriorly, without median grey-pruinulent stripe, broadly glossy across whole posterior part; each lateral plate of tergites 6 and 7 with glossy brown to black posterior zone.

Head. Height of cheek 0.23–0.35 of height of eye.

Thorax largely as given for *B. fimbria*. Subapical anteroventral spur of hind tibia variable, up to c. half as long as maximum diameter of tibia, sometimes undeveloped. Wing: apical section of vein 4 c. 3.0–4.0× as long as penultimate section; posterodistal angle of anal cell usually somewhat acute.

Abdomen. Sternite 5 divided into two transversely oval sclerites in male, undivided in female. Male postabdomen: tergite 6 reduced to pair of vestigial sclerites; sternite 6 largely symmetrical, with annular anterior marginal thickening duplicated anteroventrally to give appearance of a supernumerary sternite; epandrium slightly shorter and stouter than in *B. fimbria*, with numerous scattered moderately short setulae; anteroventral bridge occupying at least half of length of epandrium; prehypandrial membrane with few short comb-like rows of minute subconical microtrichia; surstylus with very broad gibbous strongly setulose basal expansion, beyond this more slender and strongly curved so that apex is directed anteriorly (apices of pair lying closely parallel when cerci are infolded), apical part obtuse, with spinules on inner surface; pair of hollow internal hypandrial sclerites present but shorter than in *B. merzi*; lateral hypandrial process somewhat resembling that of *B. fimbria*; inner gonite apparently absent (contrast *B. merzi*); aedeagus a little more elongate than in *B. fimbria* and *B. merzi*; basiphallus on anterior surface of aedeagus little developed, on posterior surface with pair of basally broad, distally attenuated sclerites; distiphallus with dense covering of closely packed filaments; filaments on anterior surface mostly arising from or near narrowly sclerotized lateral margin, thence directed inwards so that those of each



Figs 130–133. (130) *Borboroides bulberti*, head, frontal view. (131) Left propleural and mesopleural regions of thorax of same. (132) Apex of left hind tibia of same. (133) Cerci and surstyli of same, posterior view.

side tend to meet along anterior median line; filaments on posterior surface mostly distally to distolaterally directed, more basal ones radiating from median basal zone; cercus rather large, broadly ovate, with narrowly obtuse apex, its outer surface dull-pruinescent, except along glossy medial margin, and with scattered medium-sized setulae, on inner (or anterior) surface with strong irregularly placed setulae. Female postabdomen: tergites 6 and 7 divided in two by median desclerotization, each sclerite pruinescent anteriorly, glossy posteriorly; cercus shorter than in *B. fimbria* and *B. merzi*, not apically thickened.

Dimensions. Total length, ♂ 1.4–1.5 mm, ♀ 1.5–1.7 mm; length of thorax, ♂ 0.63–0.69 mm, ♀ 0.66–0.81 mm; length of wing, ♂ 1.7–1.8 mm, ♀ 1.7–2.1 mm.

Distribution. New South Wales: Blue Mountains and Colo River district. Victoria: probably widely distributed in eastern half of state (few records).

Notes

Borboroides bulberti resembles *B. fimbria*, *B. merzi*, and *B. acumen* in the yellow capitellum of the halter, and shining frontal zone in front of the ocelli. The males differ from other species in the large, compressed, ovate-triangular cercus with only short setulae (Fig. 133) and the broad-based surstylus with slender, anteriorly flexed apex. Otherwise, it is distinguished by having the median shining zone of the postfrons rather broad, but the non-pruinescent shining

zone on each side of the anterior ocellus is smaller and less distinct. The subapical spur of the hind tibia (Fig. 132) is often distinct but always shorter than in *B. fimbria*.

All specimens of *B. bulberti* were collected around wombat dung baits, probably mainly in natural wombat habitats.

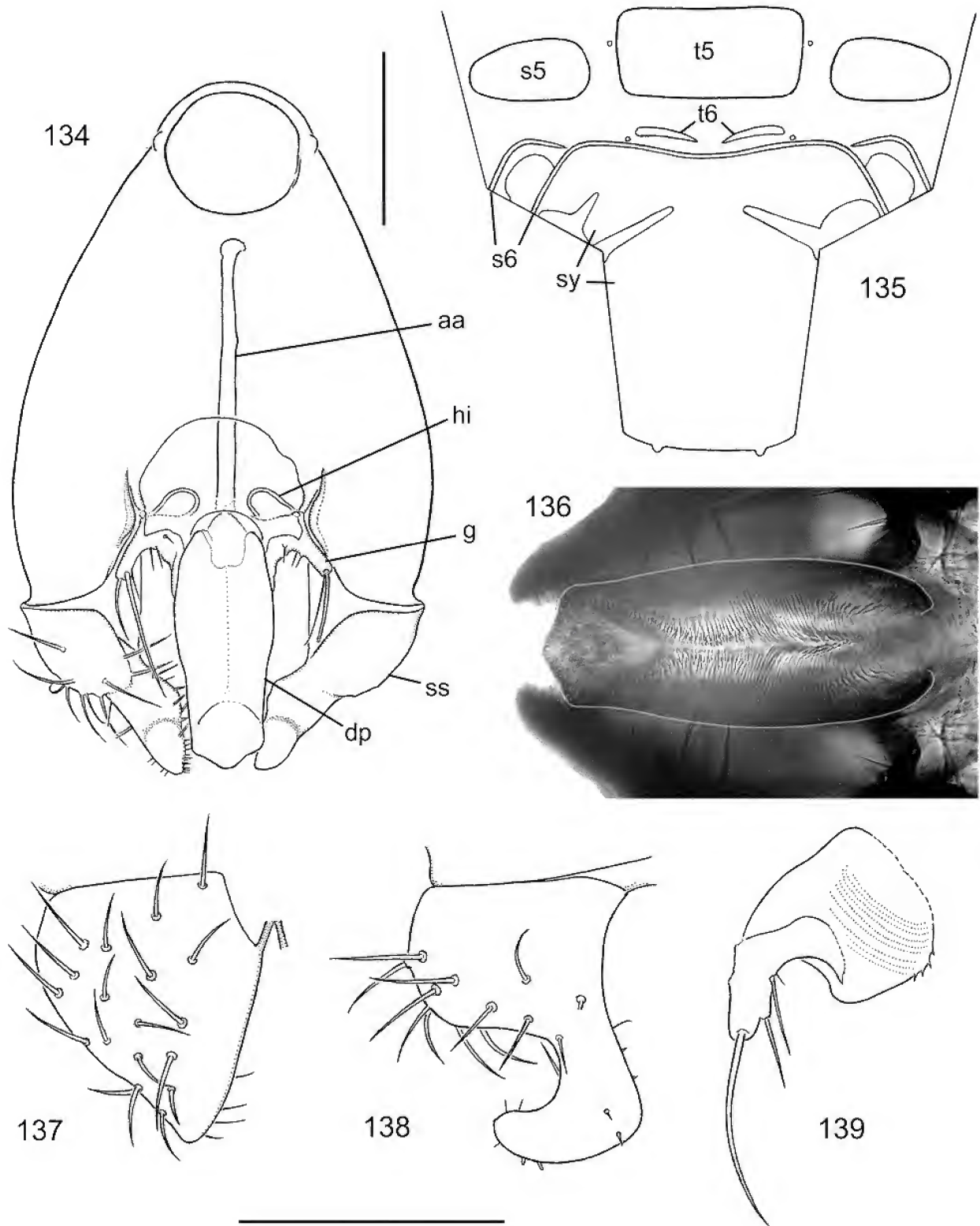
The specific epithet refers to Matthew Bulbert of the Australian Museum, whose photographic work aided this project.

Borboroides merzi n.sp.

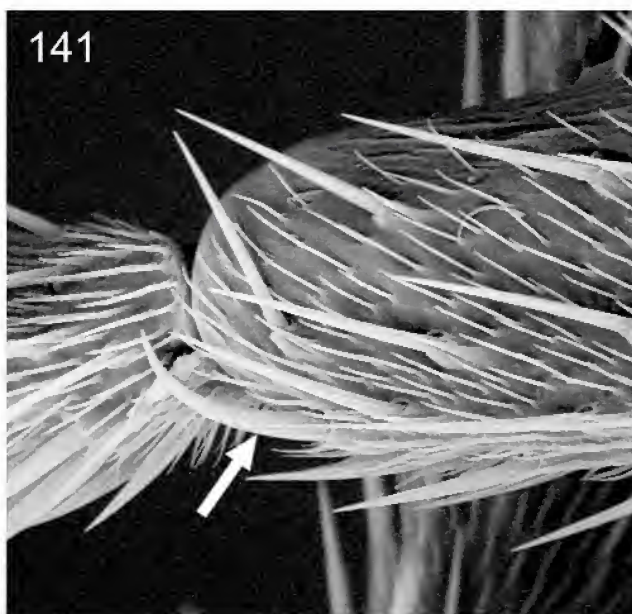
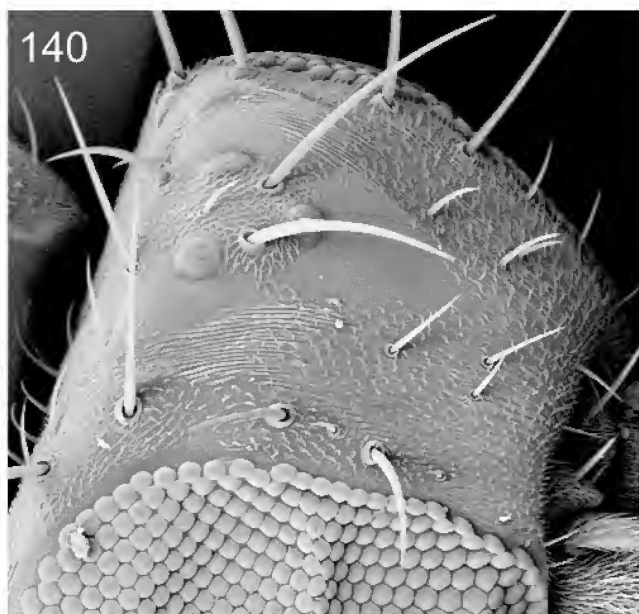
Figs 140–145

Material examined. HOLOTYPE. ♂, Australian Capital Territory: Tidbinbilla Nature Reserve—Nature Trails, 35°27'S 148°53'E [given as “35.27S/148.53E” on label], 18.x.2002, B.M.—14 (AM K219760). Double mounted on micro-pin through foam plastic. PARATYPES. Australian Capital Territory: 2♂♂, 4♀♀, same data as holotype (AM, MHNG); 1♂, Blundells Creek, 30.ix.1987, D.H.C. (ANIC).

Other material (localities only given). New South Wales: Kanangra Road, 14.2 km S of Oberon—Jenolan road junction (AM). Victoria: 13 miles [c. 21 km] W of Matlock (AM); 11 km E of Warburton (AM); near [northern foot of] Mount Juliet, 9 km E of Healesville (AM, MV). Tasmania: Forest Road, Orford (AM).



Figs 134–139. (134) *Borboroides bulberti*, epandrium and associated structures, anteroventral view, setulae omitted from epandrium and left surstylus; scale = 0.1 mm. (135) Protandrogram of same. (136) Aedeagus of same, anterior view, showing closely packed surface filaments, outline of aedeagus enhanced. (137) Left cercus of male of same, posterior view. (138) Left surstylus of same, outer surface view. (139) Left lateral process with part of lateral hypandrial sclerite, anterior view; single scale for Figs 137–139 = 0.1 mm. *aa*, aedeagal apodeme; *dp*, distiphallus; *g*, gonite; *hi*, hollow internal sclerite of hypandrium; *ss*, surstylus; *sy*, protandrial synsternite; *s5*, *s6*, sternites 5 and 6; *t5*, *t6*, tergites 5 and 6.



Figs 140–141. (140) *Borboroides merzi*, frontal region of head. (141) Apex of right hind tibia of same, anterior view.

Description (male, female). Very small blackish fly, resembling *B. fimbria* and *B. bulberti* except in male postabdominal characters, agreeing with description of former species except as indicated below.

Coloration. Postfrons black to brown-black, anteriorly sometimes tinged with reddish brown, with extensive dark greyish pruinescence anteriorly and laterally, with broad irregularly triangular glossy zone around ocelli reaching c. half distance from anterior ocellus to ptilinal suture, without lateral glossy zones. Antennal segment 3 with variable tawny suffusion. Palpus yellow. Thoracic pleura with pruinescent zones approximately as given for *B. fimbria*. Abdominal tergites 1 to 5 of male entirely grey-brown pruinescent or almost so; in female tergites 5 and 6 each pruinescent on anterior part only.

Head. Height of cheek 0.28–0.34 of height of eye.

Thorax. As described for *B. fimbria*. Femora often with bristles less strongly developed than in *B. fimbria* but variable; hind tibia with or without preapical dorsal bristle, with subapical spur minute or undifferentiated. Wing: apical section of vein 4 2.6–3.6 times as long as penultimate section.

Abdomen. Male postabdomen almost symmetrical; tergite 6 reduced to pair of small weak lateral sclerites; sternite 6 approximately symmetrical and encircling postabdomen, with pair of prominent, shining, subconical ventral processes, which are encircled and medially separated by band of heavier cuticle; area immediately behind sternite 6 (probably partly representing sternite 7) sclerotized on each side, but asymmetrically so; sternite 8 stouter than in related species, less narrowed posteriorly, with few small dorsal setulae and pair of very prominent posterior condyles, tubular for substantial part of length though ventral sclerotization; epandrium very large and bulbous, broadly tumid anterodorsally (in dried specimens usually appearing pointed in this region through partial collapse along largely membranous median dorsal line), broadly attached to protandrium, with exceptionally large dorsal subcircular membranous foramen at junction, with large desclerotized posterior region near anus (above cerci), with

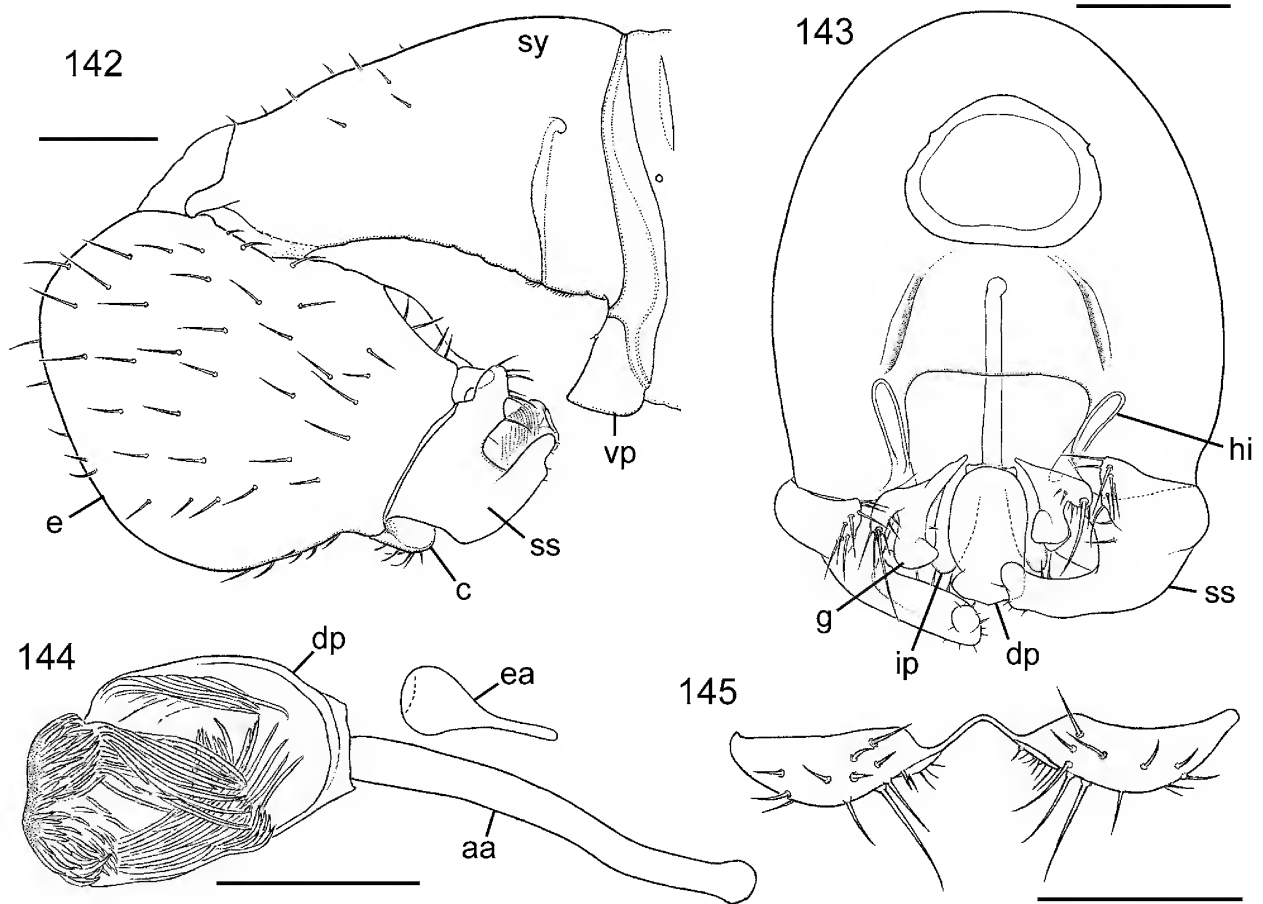
scattered small dorsal setulae, and with well-developed anteroventral bridge occupying c. 0.25 of total length of epandrium; hollow internal sclerite attached to inner surface of epandrial margin on each side of prehypandrial membrane near point of attachment of lateral hypandrial sclerite to epandrium; prehypandrial membrane with numerous short microtrichia, many of which are arranged in short transverse comb-like groups; surstylus broad basally, deeply bilobed, with both lobes directed anteriorly, shorter anterobasal lobe with several rather large setulae, distal lobe elongate, with small to minute setulae and subapical gibbosity; lateral hypandrial sclerite complex, with prominent processes, outer process with several setulae including large apical one; between lateral hypandrial sclerite and aedeagus on each side, a subelliptic process, which is probably attached basally to basiphallus; distiphallus compact, with terminal gonopore, with many filamentous processes on anterior and distal surfaces, which, unless displaced (as in Fig. 144), are neatly packed to give the impression of parallel ridges; cerci broad and very short, connected by narrow sclerotized bridge, with moderately developed setulae and with slight minutely setulose anteromedial convexity. Female postabdomen: tergite 6 and sternite 6 separate, each undivided; cercus slightly but distinctly thickened and rounded apically.

Dimensions. Total length, ♂ 1.2–1.3 mm, ♀ 1.4–1.7 mm; length of thorax, ♂ 0.54–0.63 mm, ♀ 0.62–0.73 mm; length of wing, ♂ 1.5–1.6 mm, ♀ 1.7–1.8 mm.

Distribution. New South Wales: probably only cooler districts—few records. Australian Capital Territory: Canberra–Brindabella district. Victoria: areas east of Melbourne. Tasmania: east coast (single record).

Notes

Among species of the *atra* group with the capitellum of the halter yellow, *B. merzi* is distinguished by the single broad shining zone on the postfrons and vestigial or indistinguishable anteroventral subapical spur on the hind tibia; also, in the male, by the very large epandrium, broadly



Figs 142–145. (142) *Borboroides merzi*, male postabdomen, right lateral view; scale = 0.1 mm. (143) Epandrium and associated structures of same, anteroventral view, setulae of epandrium omitted; scale = 0.1 mm. (144) Aedeagus and associated parts of same; scale = 0.05 mm. (145) Cerci of male of same, posterior view; scale 0.1 mm. *aa*, aedeagal apodeme; *c*, cercus; *dp*, distiphallus; *e*, epandrium; *ea*, ejaculatory apodeme; *g*, gonite; *hi*, hollow internal sclerite of hypandrium; *ip*, inner process of hypandrium; *ss*, surstylus; *sy*, protandrial synsternite; *vp*, ventral process (paired) of sternite 6.

connected to the protandrium and bulging at the junction so as to project posteriorly in the reflexed position (this condition apparent in dried specimens), and by numerous details of epandrial and hypandrial structure; in the female by the undivided tergite 6 with shining posterior margin and the apically gibbous cercus.

Borboroides merzi has been collected in small numbers around wombat dung baits. The Tidbinbilla Reserve was stocked with numerous native mammals when the types were collected, but was largely destroyed by fire three months later.

The specific epithet refers to Bernhard Merz, who collected what is now type material and generously made it available.

Borboroides acumen n.sp.

Figs 146–148

Material examined. HOLOTYPE. ♂, New South Wales: Kanangra-Boyd National Park, 1 km N of Boyd River [or Morong Creek] bridge, 1200 m, 4.x.2005, D.K.M. (AM K219761). Near dead chook. Mounted on card point, with postabdomen in genitalia vial on same pin. PARATYPES. New South Wales: 3 ♂♂, same data as holotype (AM, ANIC); 1 ♂,

Mount Wilson [Blue Mountains; Waterfall Reserve, c. 900 m, 33°31'S 150°23'E], 2.ix.2002, D.K.M. (AM).

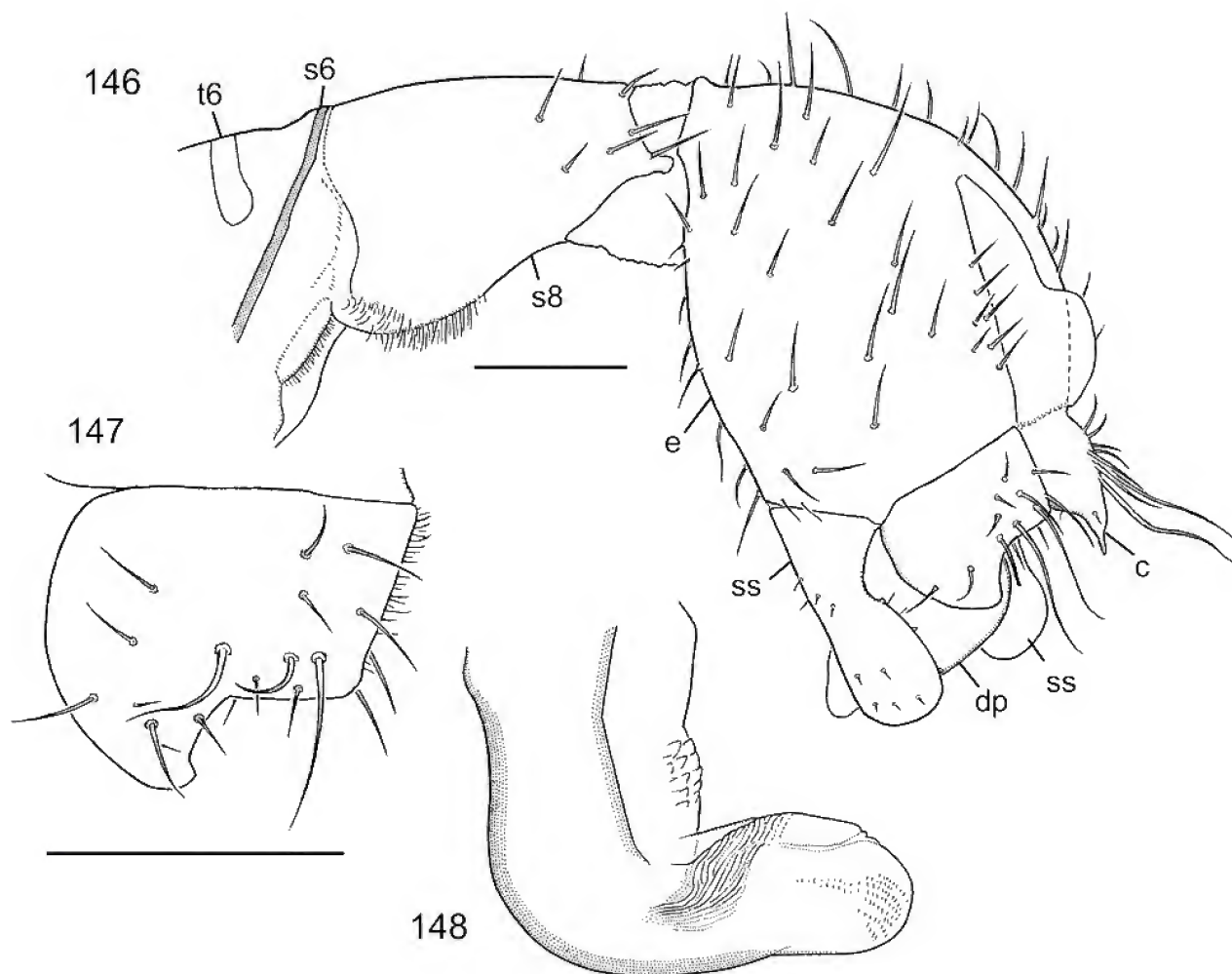
Description (male, female unknown)

Very small blackish fly, agreeing with description of *B. fimbria* except as given below.

Coloration. Postfrons with entirely black ground-colour, not paler on anterior margin, with median subtriangular glossy zone in front of anterior ocellus extending c. halfway to ptilinal suture but with large area on each side of ocelli shining, with marked fingerprint sculpture and little pruinescence, not separated from median glossy zone by distinct pruinescent strip; anterior half of postfrons and region of fronto-orbital bristles largely thinly pruinescent, but with pruinescence not extending much mesad of orbital zone. Palpus tawny-brown. Thoracic pleura with pruinescence of similar extent to that of *B. fimbria*. Halter tawny, with yellow capitellum. Abdominal tergites 1 to 3 black with brown pruinescence; tergites 4 and 5 black with brown pruinescence on median zone, shining black on lateral zone; protandrial sclerite black with extensive brown pruinescence.

Head. Height of cheek c. 0.25–0.29 of height of eye; ocellar bristle slightly larger than posterior fronto-orbital.

Thorax. Intradorsocentral setulae in c. four irregular rows. Hind femur with preapical dorsal bristle and sometimes



Figs 146–148. (146) *Borboroides acumen*, male postabdomen, left lateral view of holotype; scale = 0.1 mm. (147) Left cercus of *B. acumen* (Mount Wilson), posterolateral view. (148) Distiphallus (same specimen), right lateral view. One scale for Figs 147, 148 = 0.1 mm. *c*, cercus; *dp*, distiphallus; *e*, epandrium; *ss*, surstyli; *s6*, *s8*, sternites 6 and 8; *t6*, tergite 6.

also smaller almost apical dorsal bristle; hind tibia with subapical spur, slightly shorter than maximum diameter of tibia. Wing: apical section of vein 4 3.4–3.7× as long as penultimate section.

Abdomen. Tergite 6 well sclerotized, undivided, narrowly transverse; protandrial complex approximately symmetrical; sternite 6 dorsally imperfectly fused with sternite 8, forming dark sclerotized band entirely encircling postabdomen, ventrally with pair of anterior prominences; ventral membrane behind sternite 6 pubescent, with pair of densely pubescent sclerotized plates; sternite 8 short and very stout, its ventral bridge with particularly long, dense pubescence; epandrium rather short, broadly pyriform, with extensive anteroventral bridge and posterodorsal median desclerotization; surstylus broadly spatulate, almost straight, slightly broadened at base, but without either basal lobe or foot; prehyphandrial membrane with many rows of very short microtrichia; lateral process of hyphandrium rather stout, its rounded, tumid apex with several setulae, one longer than others; distiphallus rather large and stout, its posterior surface smooth, convex, sclerotized and darkly pigmented, anterior surface of basal part rugose-scabrous, distal section abruptly flexed forward, somewhat membranous, partly finely rugose, with subapical gonopore; cerci very broad, basally

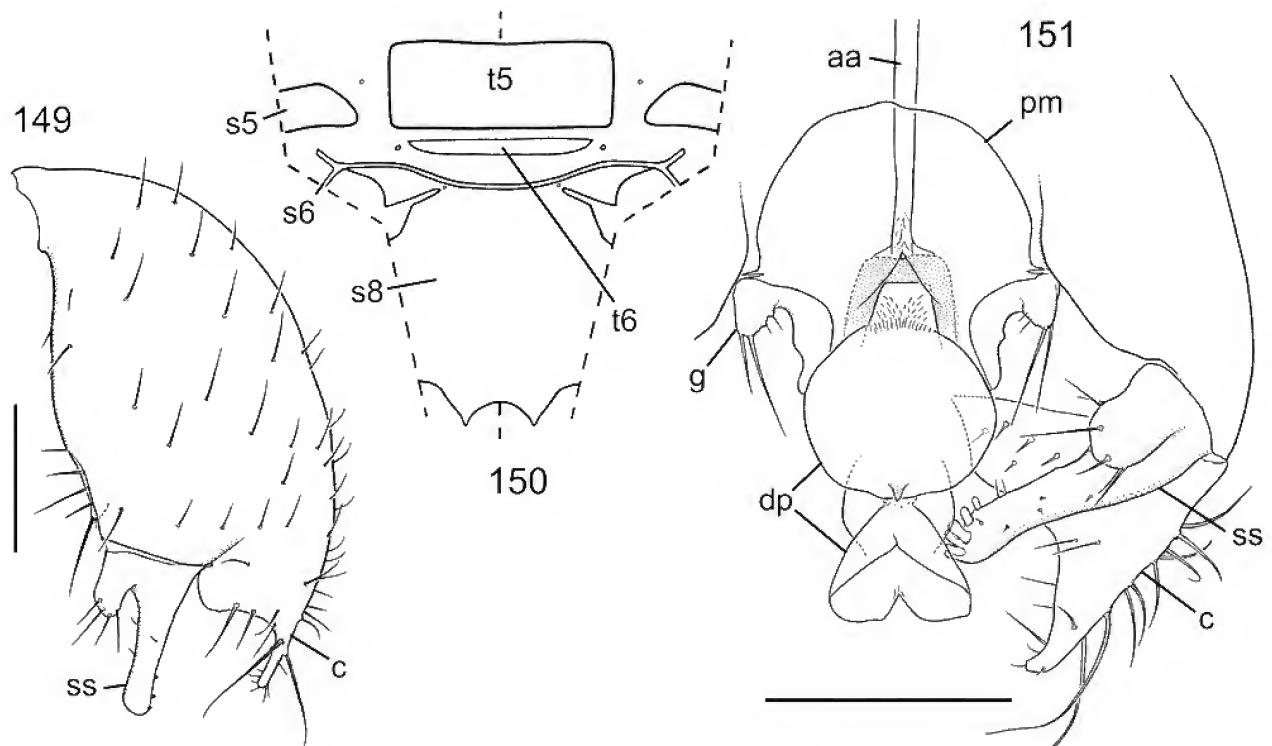
approximated to each other and broadly articulated with epandrium, medial margins of pair closely parallel, distal margin of each produced into a subacute apex (appearing acuminate from some angles), medial part thick, incrassate, outer margin and apical parts thin, lamelliform; ejaculatory apodeme moderately small and slender.

Dimensions. Total length, 1.5–1.8 mm; length of thorax, 0.67–0.76 mm; length of wing, 1.7–1.9 mm.

Distribution. New South Wales: Central Tablelands district at altitudes of c. 900 m and over (few records).

Notes

In this species the texture-pattern of the postfrons resembles that of *B. bulberti*, but the subshining area lateral to the ocelli is larger, extending well in advance of anterior ocellus, and is almost devoid of pruinescence, though with strong fingerprint ridging, and the pruinescence around the fronto-orbital bristles forms a narrow zone, isolated on its medial side but not anteriorly. This condition approaches that of *B. fimbria* which, however, has the median and lateral non-pruinescent zones separated by a pruinescent strip. The hind tibial subapical spur of *B. acumen* is shorter than in *B.*



Figs 149–151. (149) *Borboroides atra*, epandrium and associated structures, left lateral view; scale = 0.1 mm. (150) Protandrogram of same. (151) Hypandrium and structures of left side of epandrium of same, anteroventral view; scale = 0.1 mm. *aa*, aedeagal apodeme; *c*, cercus; *dp*, distiphallus; *g*, gonite; *pm*, prehypandrial membrane; *ss*, surstylus; *s5–s8*, sternites 5 to 8; *t5*, *t6*, tergites 5 and 6.

fimbria, but not much longer than in *B. bulberti*; this spur is much smaller in *B. merzi*.

Establishment of specific status for *B. acumen* depends mainly on the male postabdomen, including the shape of the surstylus and cercus. In contrast to that of *B. bulberti* and *B. merzi*, the distiphallus of *B. acumen* lacks the covering of dense filaments on both anterior and posterior surfaces.

The few specimens have been found near carrion (domestic fowl) and wombat dung baits.

The specific epithet is a Latin noun, sharpness, in reference to the sharp-edged lobe on the distal margin of the cercus.

Borboroides atra Malloch

Figs 149–151

Borboroides atra Malloch, 1925: 85–86, fig. 2.

Material examined. HOLOTYPE. ♀, New South Wales: Sydney, 1.xi.1924, “Health Dept.” (AM, formerly in SPHTM, K83965). Head missing. Author’s determination label (in error): “*Borboroides australis* Type Det J.R.Malloch”; see Lee *et al.* (1956: 308) for comment.

Other material (localities only given). Queensland: Tinaroo Falls–Danbulla Road, Atherton Tableland (ANIC); Wombye, near Nambour (ANIC); Deception Bay (ANIC); Mount Glorious (AM, MHNG); Manorina (Mount Nebo) (MHNG); Tamborine Mountain and vicinity (AM, MHNG); Binna Burra, Lamington National Park (ANIC); Box Forest Walk, Cunningham’s Gap, 28°03’S 152°23’E (AM). New South Wales: 20 miles [c. 32 km] E of Glen Innes (ANIC); Mount Gibraltar National Park, 72 miles [c. 116 km] W

of Grafton (AM); Mount Kaputar, near Narrabri (AM); Baradine (ANIC); 7 miles [c. 11 km] E of Mendooran (AM, CNC); Goonoo State Forest, 5 miles [c. 8 km] S of Mendooran (AM); Lahey’s Creek Road, 12 km NW of Gulgong (AM, USNM); Wongarbon Nature Reserve, 17 km SE of Dubbo (AM, BM); Stroud (AM, MHNG); Parkes (AM); Mount Canobolas, near Orange (AM); Doyle’s Creek, near Singleton (AM); Myall Lakes National Park (AM); Putty Road, 41 km N of Colo River bridge (AM, NAT, TAU); Colo Heights (AM); Blue Mountains (Mount Wilson, Katoomba, Lawson, Springwood) (AM); Eugowra (ANIC); Royal National Park, near Sydney (AM, MNHG); Kanangra-Boyd National Park (AM); Young (ANIC); Minnamurra Falls, Kiama district (ANIC); Shoalhaven River, near Braidwood (ANIC); Clyde Mountain, Braidwood district (ANIC); Durras Lake (ANIC); 4 miles [c. 6 km] N of Bateman’s Bay (ANIC); Wallaga Lake, near Bermagui (ANIC); Brockelo’s Creek, 16.5 km S of Bermagui (ANIC); Araluen (ANIC); 4 miles [c. 6 km] E of Nimmitabel (ANIC); Brown Mountain, Bega district (ANIC); 3 km N of Wolumla, Merimbula district (AM); Tantawangalo Forest, near Candelo (AM). Australian Capital Territory: Black Mountain, Canberra (ANIC, MNHG). Victoria: 7 km SW of Bruthen (AM); Providence Ponds, 32 km W of Bairnsdale (AM, MV); 6 km S of Beechworth (AM, MV); Toolangi State Forest, 31 km S of Yea (AM, MV); 11 km E of Warburton (AM); 9 km E of Healesville (AM); Pirron Yallock, 8 miles [c. 13 km] W of Colac (ANIC); Mount William, Grampians (AM); Wyperfield National Park, 47 and 51 km NW of Hopetoun (ANIC). Tasmania: Weldborough Pass (AM, TDPI); 3 km NW of Saint Helens (AM); 4 km NW of Bicheno (AM); Forest Road, Orford (AM); 3 km S

of Copping (AM); Mount Field National Park (AM, TDPI); Ferntree, near Hobart (AM); 8 km W of Geeveston (AM); The Neck, Bruny Island (AM). South Australia: Ravine des Casoars, Kangaroo Island (AM).

Description (male, female). Very small blackish fly, agreeing with description of *B. fimbria* except as indicated below.

Coloration. Postfrons usually with some yellow to tawny coloration on anterior margin, otherwise with texture-pattern as given for *B. fimbria*; cheek region usually partly yellowish to tawny anteriorly. Antenna with segment 2 tawny-yellow, segment 3 partly tawny-yellow, partly dark brown. Mesopleuron with posterior pruinescent zone becoming slightly diffuse at lower end. Halter, including capitellum, grey-brown. Abdominal tergite 6 of female grey-brown pruinescent except on bare black lateral zone.

Head. Height of cheek 0.24–0.39 of height of eye. Arista as long as greatest diameter of eye or almost so.

Thorax. Usually one distinct dorsocentral bristle present, or if short secondary dorsocentral present, it is close in front of major one; prescutellar acrostichal bristle absent or slightly differentiated. Hind femur usually with preapical dorsal bristle; hind tibia with subapical spur slightly shorter than greatest diameter of tibia, very slightly curved. Wing: apical section of vein 4 3.2–3.9 times as long as penultimate section.

Abdomen. Male postabdomen: tergite 6 undivided; spiracle 7 minute, but apparently open; epandrium shorter and more compact than in *B. fimbria*, with broad anteroventral bridge; surstylus with rather broad base, giving rise to: (a) stoutly rod-like main shaft with few, mostly short setulae and, on inner surface near apex, some stout, blunt spinules, and (b) an equally stout, rounded, outwardly inclined setulose tubercle (often evident even when surstylus is inflexed); lateral sclerite of hypandrium at inner end convex and embracing base of aedeagus, at outer end with setulose knob-like process against margin of epandrium, but with no other process or prominence; aedeagal apodeme free, significantly longer than in *B. fimbria*; aedeagus with bulbous anterobasal part, not strongly sclerotized, but densely scabrous, with coarse denticles, dentate ridges, and, near base, dense pubescence, with partly sclerotized distal section from which arises a terminal largely membranous funnel containing gonopore and some ridging in throat; cerci broad, separate from each other, but broadly fused with epandrium at bases, there being no line of articulation for most of basal width, with narrowed, almost styliform apical prolongation and both small and large setulae.

Dimensions. Total length, ♂ 1.2–1.4 mm, ♀ 1.2–1.8 mm; length of thorax, ♂ 0.54–0.69 mm, ♀ 0.60–0.86 mm; length of wing, ♂ 1.3–1.5 mm, ♀ 1.4–1.9 mm.

Distribution. Queensland: most records from southeastern districts, one isolated record from tropics—Atherton Tableland. New South Wales: very widely distributed in eastern third of state. Victoria: apparently generally distributed. Tasmania: generally distributed at least in eastern districts. South Australia: Kangaroo Island—identification check from males desirable. We have found *B. atra* to be the most abundant species of *Borboroides* in most eastern Australian habitats.

Notes

Borboroides atra resembles other species of the *atra* group, having only one well-developed dorsocentral bristle, two long outwardly directed fronto-orbital bristles, and short but sclerotized distal section of vein 6. In most characters it resembles *B. fimbria*: both species share the possession of three separate large shining black zones on the postfrons. This condition is best appreciated in dry specimens under SLM with lighting arranged to show up the pruinescent areas. *Borboroides atra* differs from *B. fimbria* and all other species of this group in the largely greyish brown halteres, and, in the males, numerous characters of the postabdomen, including the long-acuminate cercus basally fused to the epandrium.

The holotype female of *B. atra* now lacks the head, but the present application of this name is justified by what remains of the specimen, together with the statement by Malloch that the frons is smooth and shining (at least in part).

Borboroides atra has often been collected by general sweeping, and also in large numbers around wombat dung baits and old carcasses.

Borboroides woodhilli n.sp.

Figs 152–154

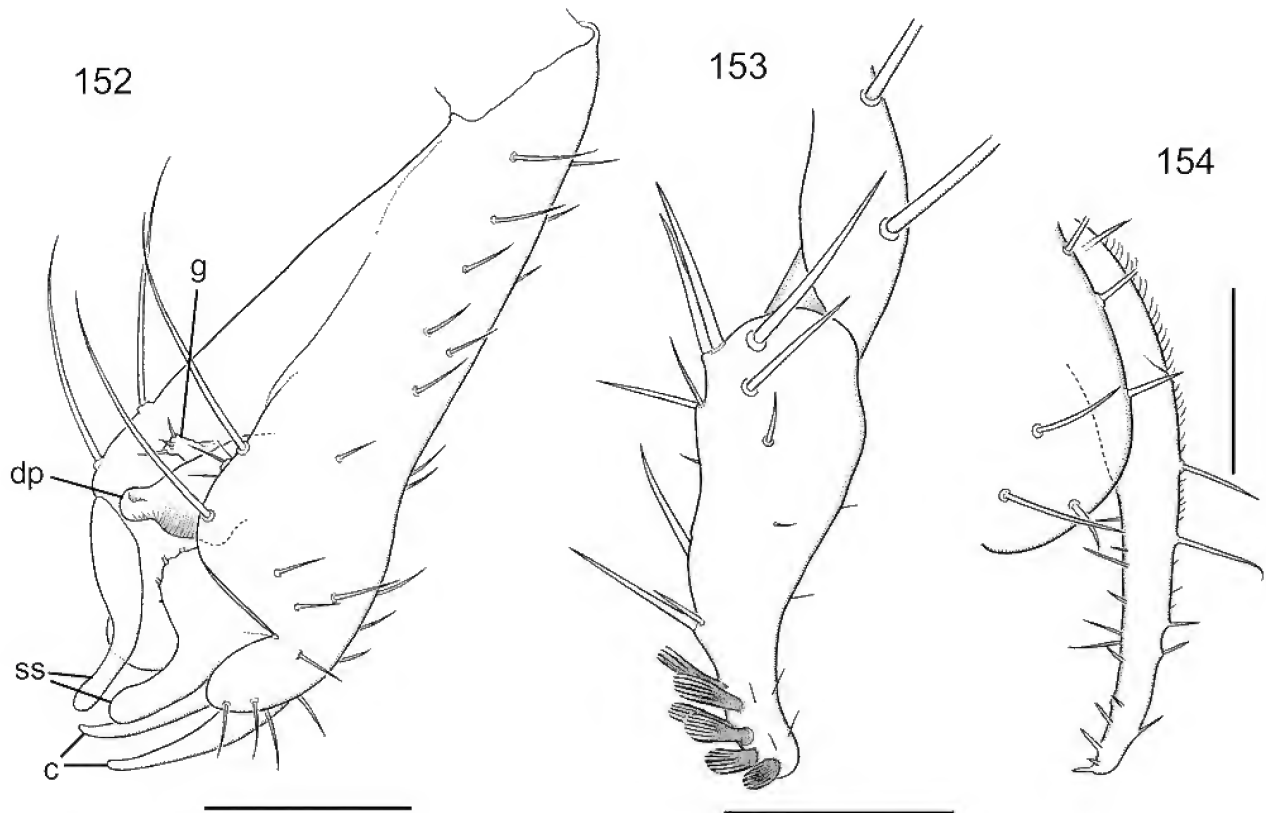
Material examined. HOLOTYPE. ♂, Western Australia: Boranup, near [NW of] Karridale, 3.x.1970, D.H.C. (ANIC). Double-mounted on micro-pin, postabdomen in genitalia vial on same pin. PARATYPES. Western Australia: 1 ♂, 8 mi. [c. 13 km] N of Bunbury, 1.x.1970, D.H.C. (AM); 1 ♂ (damaged), 3 miles [c. 5 km] SW of Karridale, 3.x.1970, D.H.C. (ANIC); 1 ♀, Cape Naturaliste [near Dunsborough], 1.x.1970, D.H.C. (ANIC); 3 ♀ ♀, Meerup Springs Farm, near Northcliffe, 34°39'S 116°05'E, 27–28.xi.1998, B.J.D., D.K.M. (AM, WAM); 2 ♀ ♀, William Bay, W of Denmark, 10.x.1970, D.H.C. (ANIC).

Description (male, female). Minute blackish fly, agreeing with description of *B. fimbria*, except as indicated below.

Coloration. Postfrons entirely black in fresh specimens (fading to brown), more extensively shining than in other species of *atra* group, pruinescent between ocelli, elsewhere with very little pruinescence, even on anterior half, with a little very fine fingerprint ridging, thus any glossy zones (present in *B. atra* and *B. fimbria*) not sharply defined. Antenna: segment 3 generally entirely dark brown or almost so. Palpus tawny-brown to dark brown. Mesopleuron with very narrowly grey-pruinescent upper and posterior margins. Legs brown; fore coxa dark brown, with grey-pruinescent anterior surface. Abdomen: tergite 5 of female shining blackish, with anterior margin very broadly grey-pruinescent.

Head. Height of cheek 0.36–0.46 of height of eye.

Thorax. Intradorsocentral setulae in two pairs of irregular rows anteriorly, or only the inner series distinct. Hind tibia with subapical spur distinct, but smaller than in *B. fimbria*. Wing: apical section of vein 4 3.3–4.6× as long as penultimate section.



Figs 152–154. (152) *Borboroides woodhilli* (near Bunbury) epandrium and associated structures, left lateroventral view; macrotrichia on cerci and surstyli omitted; scale = 0.1 mm. (153) Left surstylus of same (Boranup), anterior view; scale = 0.05 mm. (154) Left cercus of male of same (Boranup), lateral view; scale = 0.05 mm. *c*, cerci; *dp*, distiphallus; *g*, right gonite; *ss*, surstylus.

Abdomen. Preabdomen apparently similar to that of *B. fimbria*. Male postabdomen: tergite 6 not observed; compound protandrial sclerite very long and slender, longer than preabdomen (in available dried specimens), with pair of very prominent posterior condyles (details of anterior part not investigated); epandrium very elongate, anteriorly tapering, posteriorly somewhat swollen, with general outline thus clavate, laterally and dorsally with scattered short setulae and, on each lateral margin just anterior to surstylus, two very long bristles, lateral margin near posterior end deeply V-cleft to accommodate posterobasal angle of surstylus; anterior foramen of epandrium of moderate size, very oblique; anteroventral bridge of epandrium very extensive, occupying perhaps half length of epandrium (posterior delimitation of bridge and prehyandrial membrane not discernable in preparations); surstylus broad on basal articulation with epandrium, with rounded anterobasal gibbosity, more slender posteriorly inclined distal part, and rounded apex, with setulae of various sizes some on anterobasal gibbosity large but simple, those on outer distal surface very small, and about six to ten modified spinules on inner distal surface, each stout basally, with distal fan-like fascicle of c. four to six rigid branches, in most cases lying in plane approximately transverse to longitudinal axis of surstylus; process of lateral hypandrial sclerite moderately short, with three terminal setulae; distiphallus stoutly ovoid, with small contracted but tumid apical section, its entire visible surface covered with fine, mostly closely parallel and transverse sclerotized ridges,

with gonopore apparently on anterior surface close to apex; cerci closely approximated basally and thus remote from surstyli, rod-like, slender and slightly tapered distally, only slightly expanded basally, with rather numerous medium to small setulae.

Dimensions. Total length, ♂ 0.91–1.14 mm, ♀ 1.2–1.4 mm; length of thorax, ♂ 0.46–0.54 mm, ♀ 0.51–0.70 mm; length of wing, ♂ 1.2–1.3 mm, ♀ 1.2–1.6 mm.

Distribution. Western Australia: high rainfall districts south of 33°S and west of 118°E.

Notes

Borboroides woodhilli is a little known species of the *atra* group generally resembling *B. fimbria* and other species with pale capitellum and a single dorsocentral bristle. Among these species it is distinguishable by the greatly reduced pruinescence of the postfrons (at least for clean, dry specimens), but, as usual, the most marked distinctions are in the male postabdominal characters, including the elongate, attenuated cercus and the digitate spinules on the distal part of the surstylus.

The few female specimens which B.J.D. and I collected were on fresh fox dung.

The specific epithet refers to Anthony R. Woodhill, formerly of the University of Sydney, on whose advice (1954) I took up the study of the Diptera.

Genus *Heleomicra* McAlpine

Heleomicra D. McAlpine, 1985: 205, 210. Type species (original designation) *H. collessi* D. McAlpine.

Description (significant diagnostic characters only).

Head. Paravertical bristle absent; fronto-orbitals 2, both long, directed outwards; cheek with a central series of setulae (in addition to variably developed peristomial series). Antenna almost porrect; distal articular surface of segment 2 much less oblique than in *Borboroides*, with stout cone covered with numerous encircling series of fine-tipped and blunt spinule-like microtrichia; segment 5 less elongate than in *Borboroides*.

Thorax. Subscutellum convex and rather deep, but not wide; dorsocentral bristles one pair; mesopleuron without setulae. Tibiae without preapical dorsal bristles. Wing: costa without any enlarged bristles or spines beyond pair of

costagial bristles; subcosta desclerotized and unpigmented distally, slightly narrowed at level of c. basal third of second costal cell; basal crossvein very oblique.

Abdomen. Sternite 1 sclerotized, compact and undivided. Male: protandrium not forming a petiole, section representing sternite 8 large, without separate ventral bridge; epandrium without sclerotized anteroventral bridge; hypandrium well sclerotized in front of basiphallus; gonite absent; basiphallus large, sclerotized on posterior surface, sheath-like, with distiphallus folding into its anterior concavity, and with double-headed process arising in front of base; aedeagal apodeme long. Female: tergite 5 much shorter and narrower than tergite 4.

Distribution. New South Wales: widely distributed. Victoria: scattered records in east of state. Tasmania. South Australia: single record.

Key to species of *Heleomicra*

- 1 Mesopleuron pruinulent on entire posterior margin; male: surstylus complexly lobed and setulose, but without finger like lobe bearing single terminal setula; cercus deeply bilobed; female: abdominal tergite 4 almost entirely thinly pruinulent *collessi* (p. 217)
- Mesopleuron with posterodorsal pruinulent zone and smaller posteroventral pruinulent zone, but intervening part of posterior margin with little or no pruinulence; male: surstylus distally with three lobes, one of them finger-like with single elongate terminal setula; cercus undivided (sometimes not easily visible in dried specimens); female: abdominal tergite 4 largely smooth and glossy, with pruinulent zone along anterior margin *lenis* (p. 214)

Heleomicra lenis n.sp.

Figs 155–164

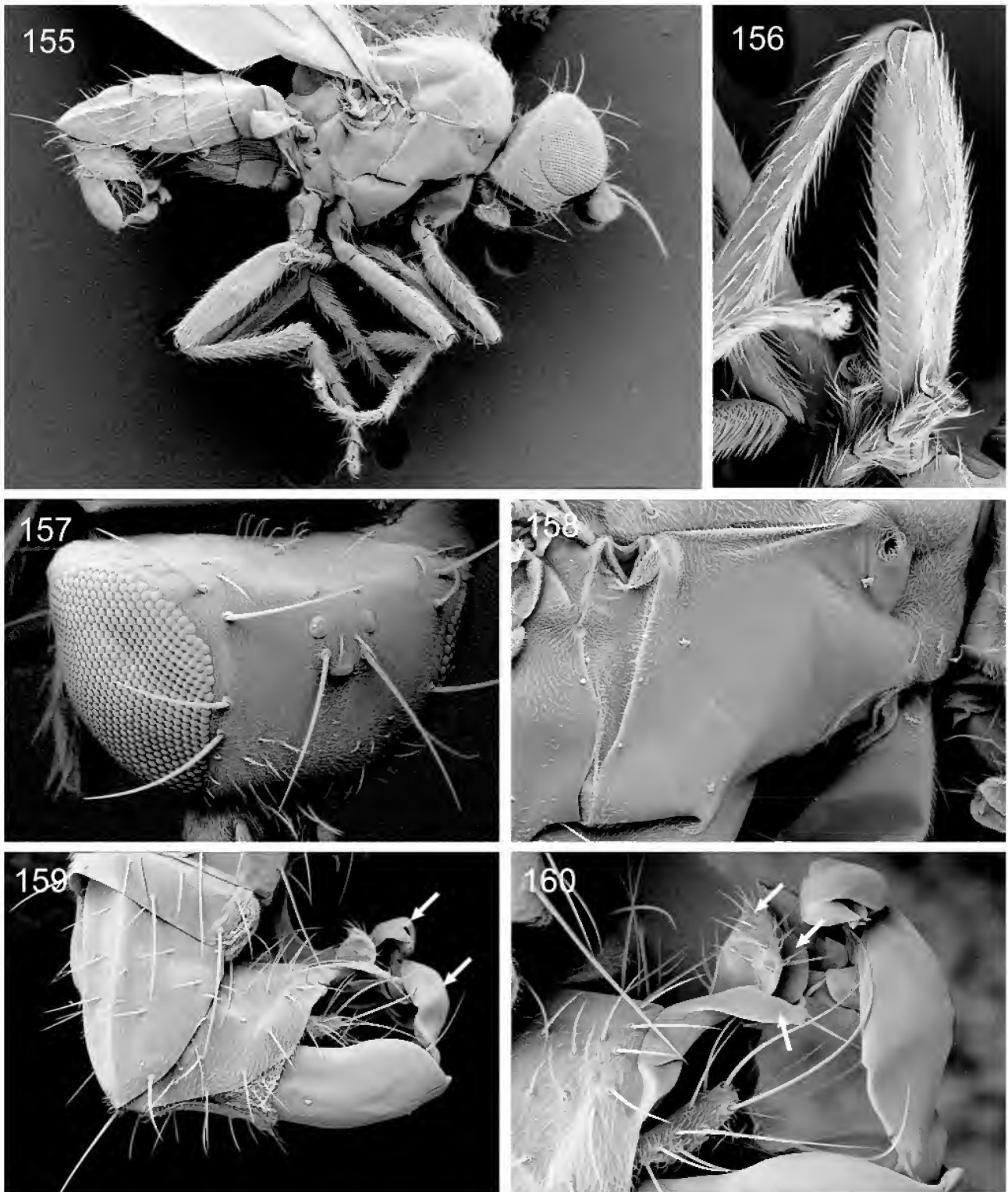
Material examined. HOLOTYPE. ♂, New South Wales: Kanangra-Boyd National Park, 1 km N of Boyd River [or Morong Creek] bridge [1200 m], 4.x.2005, D.K.M. (AM K219762). Near dead chook. Mounted on card point. PARATYPES. New South Wales: 49 ♂♂, 27 ♀♀, same data as holotype, but some Sept. 2005 (AM, ANIC, USNM); 5 ♂♂, 4 ♀♀, Boyd River crossing, Kanangra-Boyd National Park, April 2002–2004, B.J.D., D.K.M. (AM); 5 ♂♂, Mount Wilson, Blue Mountains, April, Sept. 2002–2004 (AM); 2 ♀♀, Rudy's Road turnoff, 15 km N of Jenolan, April 2004, B.J.D. (AM).

Other material. Victoria: Toolangi State Forest, 31 km S of Yea (AM, MV); 11 km E of Warburton (AM, MV); near Mount Juliet, 9 km E of Healesville (AM); Swan Reach (ANIC); Lilly Pilly Track, Wilson's Promontory (ANIC). Tasmania: Forest Road, Orford (AM); The Neck, Bruny Island (AM); Mount Field National Park (AM, TDPI); Lake Saint Clair (ANIC); 10 mi. [c. 16 km] E of Strahan (ANIC); Lyell Highway, Franklin–Gordon Wild Rivers National Park (AM).

Description (male, female). Very small largely black fly with unmarked wing, superficially resembling smaller species of *Borboroides*.

Coloration. Postfrons black, usually becoming brown-black to tawny brown anteriorly, dull greyish-pruinulent, except on large shining black zone on each side of ocellar triangle; face tawny to tawny brown; cheek tawny-brown with grey-pruinulent zone; occipital region dull black. Antenna brownish; segment 3 with extensive tawny zone. Prelabrum greyish brown to black; palpus yellowish. Thorax black to brown-black; mesoscutum and scutellum extensively but not densely grey-brown pruinulent; mesopleuron largely shining to glossy, with greyish pruinulent posterodorsal zone of variable size and usually much smaller posteroventral such zone, the two zones generally well separated by shining or glossy area extending to posterior margin; sternopleuron smooth, glossy, except for narrow pruinulent zone on upper margin. Legs dark brown to tawny brown; femora usually darker than other parts; fore and mid coxae largely yellowish. Wing membrane slightly smoky; veins brown. Halter tawny to brown, with dull yellow capitellum. Abdomen largely black; in some females, tergites with translucent tawny-yellow areas; in female tergite 4 largely smooth and glossy, pruinulent along anterior margin, sometimes more broadly so on median line; tergites 5 and 6 densely grey-pruinulent.

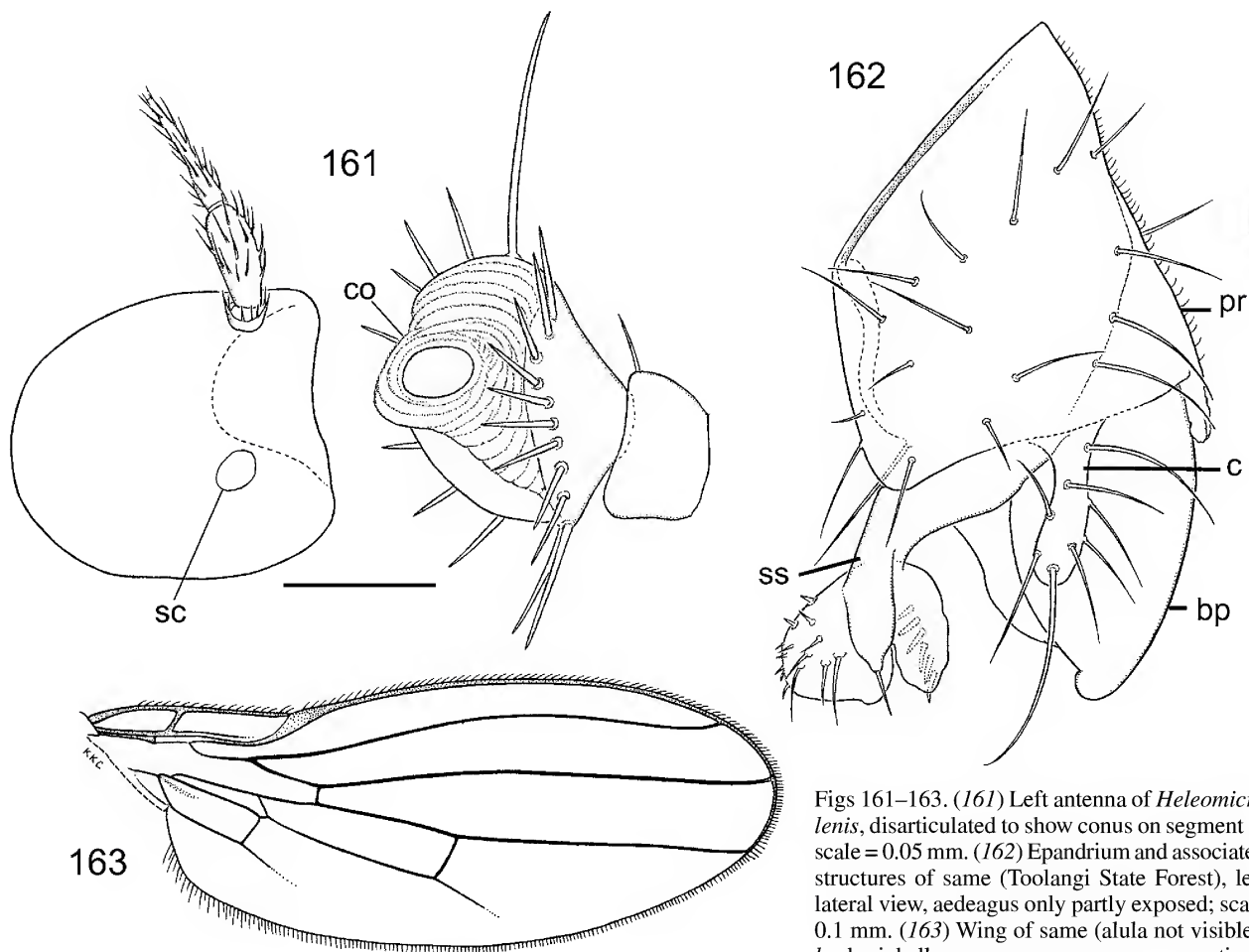
Head higher than long; eye rounded, usually slightly higher than long in profile; postfrons with short setulae on anterior half; face concave; height of cheek 0.26–0.37 of height of eye; cheek with two series of setulae (including peristomial series); the following bristles present: long inner



Figs 155–160. (155) *Heleomicra lenis*, male, Kanangra-Boyd National Park. (156) Hind femur of same, anterior to anteroventral view. (157) Head of same, dorsal oblique view. (158) Right propleural and mesopleural regions of same. (159) Postabdomen of same, right lateral view; distiphallus indicated (two parts). (160) The same, detail of right surstylus and distiphallus; three lobes of surstylus indicated; for identification of some parts see Fig. 162.

and outer vertical, shorter but strong crossed postvertical, long ocellar, two long, subequal, strongly eclinate fronto-orbitals, moderate-sized vibrissae. Prelabrum of female moderately developed, that of male markedly smaller; palpus moderately short.

Thorax. Intradorsocentral setulae in two pairs of rows; mesopleuron without setulae; the following bristles present: small humeral, presutural, 1+1 notopleurals, small or poorly differentiated supra-alar, long postalar, small posterior intra-alar, 0+1 dorsocentral, two pairs of scutellars, one



Figs 161–163. (161) Left antenna of *Heleomicra lenis*, disarticulated to show conus on segment 2; scale = 0.05 mm. (162) Epandrium and associated structures of same (Toolangi State Forest), left lateral view, aedeagus only partly exposed; scale 0.1 mm. (163) Wing of same (alula not visible). *bp*, basiphallus; *c*, cercus; *co*, conus; *pr*, proctiger; *sc*, sacculus; *ss*, surstylus.

rather small sternopleural. Fore femur with several long, irregular posterodorsal bristles and moderately developed posteroventral ones; mid femur with one moderate-sized anterior bristle near or beyond mid-length and smaller subapical anterior and posterior bristle; hind femur of male with a distinct series of posteroventral setulae, arising from prominent basal sockets and becoming smaller and more crowded distally, without dorsal and anterodorsal bristles in either sex; fore and hind tibiae without preapical dorsal or other bristles or spurs; mid tibia with an anterior and a posteroventral subapical spur, sometimes also with slightly differentiated posterodorsal subapical bristle; hind basitarsus *c.* as long as fore basitarsus but slightly thicker, shorter than mid basitarsus. Wing as for genus; apical section of vein 4 2.1–2.4× as long as penultimate section.

Abdomen. Male postabdomen: protandrial sclerites as for genus (Fig. 164); surstylus, moveable from base, subject to extension and some twisting (positional designation of parts based on position shown in Fig. 162), with posterobasal foot extending to near cercus, narrowed beyond base, distally with three prominent lobes; outer lobe tapered distally with only one, terminal setula; anterior lobe broad, with several non-seriate setulae of different sizes; posterior lobe with a series of spinescent setulae; large horseshoe-shaped hypandrial sclerite present in front of base of aedeagus, with well sclerotized anterior and lateral margins; basiphallus broader than in *H. collessi*; cercus simple, undivided, with long setulae; proctiger membranous, with median posterior lobe.

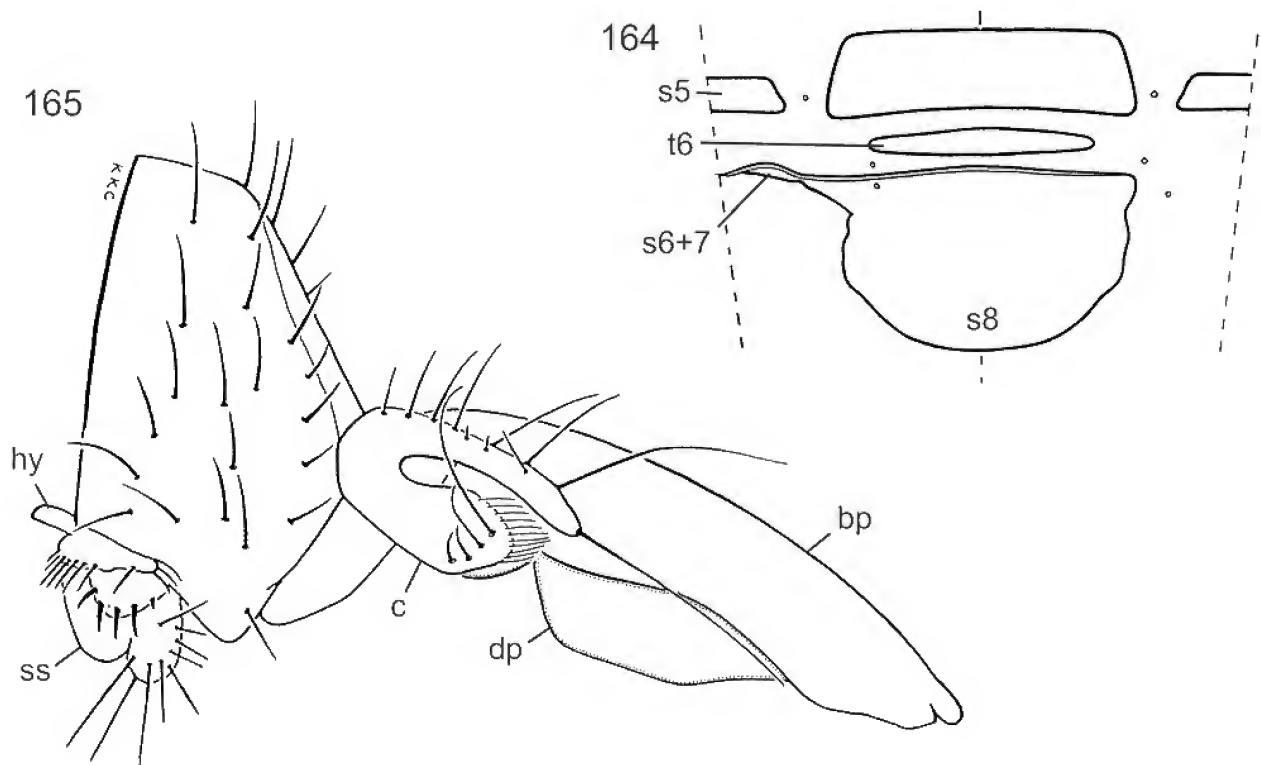
Female postabdominal segments progressively narrowed, extensile; tergites 6, 7, and 8 sclerotized, undivided; spiracles 1 to 6 in pleural membrane (spiracle 7 not seen but possibly present); cerci elongate ovoid, joined by membrane for part of length; spermathecae three, with black vesicles, each with long slender separate duct, which is darkly pigmented on distal part and joins a nipple-like extension of vesicle (ducts not traced to origins).

Dimensions. Total length, ♂ 1.2–1.4 mm, ♀ 1.3–1.8 mm; length of thorax, ♂ 0.61–0.72 mm, ♀ 0.67–0.82 mm; length of wing, ♂ 1.7–2.1 mm, ♀ 2.1–2.4 mm.

Distribution. New South Wales: cooler parts of Central Tablelands division. Victoria: probably widely distributed in eastern half of state. Tasmania: probably widely distributed.

Notes

Heleomicra lenis is exceedingly similar to *H. collessi*, and a full statement of specific differences is difficult because so few specimens of *D. collessi* are available. The differences in the cercus of the males, apparently together with details of the surstylus, indicate fairly clearly that two species are involved, and careful study of available material seems to support the significance of the distribution of pruinescence on the mesopleuron of both sexes and tergite 4 of the female in distinguishing the species. However, some individual



Figs 164, 165. (164) *Heleomicra lenis*, protandrogram. (165) *Heleomicra collessi*, epandrium and associated structures, left lateral view, aedeagus posteriorly extended. *bp*, basiphallus; *c*, cercus; *dp*, distiphallus; *hy*, hypandrium; *ss*, surstylus; *s5*–*s8*, sternites 5 to 8; *t6*, tergite 6.

variation in these features seems to be present. It is also possible that additional unrecognized species are present in the poorer samples.

Heleomicra lenis has sometimes been found round wombat dung baits, but the large series from the type locality was taken round old domestic fowl carcasses. In Mount Field National Park, Tasmania, I swept several specimens from a tree hollow in a fire-damaged *Eucalyptus*.

The specific epithet is a Latin adjective meaning smooth in reference to the smaller amount of pruinescence on the thorax and female abdomen than in *H. collessi*.

Heleomicra collessi McAlpine

Fig. 165

Heleomicra collessi D. McAlpine, 1985: 210–211, figs 11–14.

Material examined. HOLOTYPE. ♂, New South Wales: 5 mi. [c. 8 km] S of Mendooran, 1–3.v.1970, G.A.H., D.K.M. (AM K83976). On or near kangaroo carcass. The holotype was much damaged during the data-basing process. PARATYPES. See D. McAlpine, 1985 (AM, ANIC).

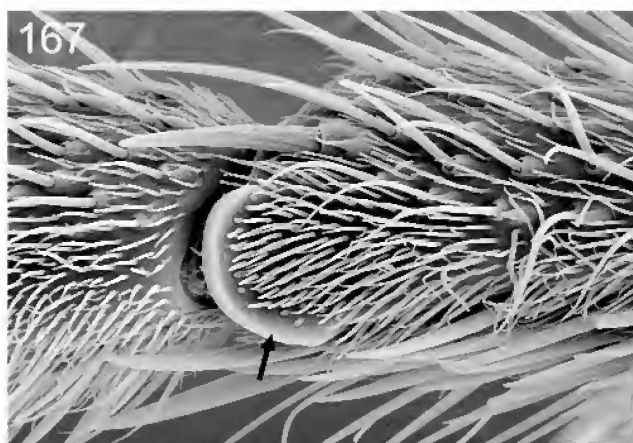
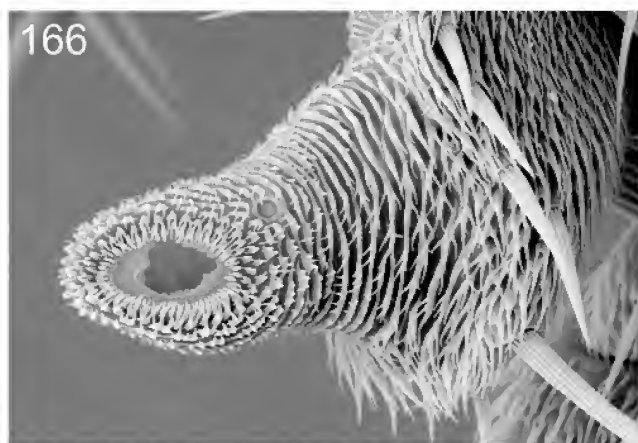
Other material (provisionally referred to *H. collessi*). New South Wales: 1 ♀, Tinda Creek, Putty Road, 33°10'S 150°42'E, May 2002, D.K.M. (AM); 2 ♀♀, Putty Road, 41 km N of Colo River bridge [Yengo National Park], 33°11'S 150°41'E, c. 220 m, May 2002–2005, D.K.M. (AM); 1 ♀, Kanangra-Boyd National Park, 1 km N of Boyd River bridge, 1200 m, Oct. 2005, D.K.M. (AM); 1 ♀, Boyd River crossing, Kanangra-Boyd National Park, April 2004, D.K.M. (AM). South Australia: 1 ♀, Hahndorf, Aug. 1968, D.H.C, Z.R.L. (ANIC).

Description. See D. McAlpine (1985).

Distribution (few records). New South Wales: perhaps more plentiful in warmer areas than those preferred by *H. lenis*, though living through a wide range of altitudes (if determinations of females are accurate). South Australia: Adelaide Hills district.

Notes

Heleomicra collessi remains a little known species. The few available specimens obtained since its original description include no males. See under *H. lenis* and the key to species for comparative data (pp. 145, 147 and 157).



Figs 166, 167. (166) *Borboroides musica*, antennal segment 2, outer lateral view of conus, after separation of segment 3. (167) *Leriopsis montana* McAlpine, male, articulation between fore-tarsal segments 1 and 2, ventral view, apical ventral process of segment 1 indicated.

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